



Massachusetts Military Reservation

PLUME RESPONSE PROGRAM

Final FS-28 Time Critical Action Memorandum

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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS	v
PREFACE	ix
1.0 PURPOSE	1-1
2.0 SITE CONDITIONS AND BACKGROUND	2-1
2.1 SITE DESCRIPTION	2-1
2.1.1 Removal Site Evaluation.....	2-2
2.1.2 Physical Location	2-2
2.1.3 Site Characteristics.....	2-3
2.1.4 Release or Threatened Release of Contaminants into the Environment.....	2-6
2.1.5 National Priorities List Status	2-8
2.2 OTHER ACTIONS	2-8
2.2.1 Previous Actions	2-8
2.2.2 Current Actions	2-11
2.3 ROLE OF STATE AND LOCAL AUTHORITIES	2-11
2.3.1 State and Local Actions to Date.....	2-12
2.3.2 Potential for Continued State and Local Response	2-15
3.0 THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES	3-1
3.1 THREATS TO PUBLIC HEALTH OR WELFARE.....	3-1
3.2 THREATS TO THE ENVIRONMENT	3-1
4.0 ENDANGERMENT DETERMINATION	4-1
5.0 PROPOSED ACTIONS AND ESTIMATED COSTS	5-1
5.1 PROPOSED ACTIONS	5-1
5.1.1 Proposed Action Description	5-2
5.1.1.1 Operation and Maintenance of the CWSW Wellhead Treatment System	5-3
5.1.1.2 Residential Well Sampling and Public Water Supply Replacement	5-3
5.1.1.3 Environmental Monitoring.....	5-4
5.1.1.4 Time-Critical Removal Action.....	5-6
5.1.1.5 Interim Action	5-8

TABLE OF CONTENTS

5.1.1.6 Ecological Impact Monitoring	5-9
5.1.1.7 Irrigation Wells	5-9
5.1.2 Contribution to Remedial Performance	5-13
5.1.3 Description of Alternative Technologies	5-13
5.1.4 Applicable or Relevant and Appropriate Requirements (ARARs)	5-13
5.1.5 Project Schedule.....	5-13
5.2 ESTIMATED COSTS.....	5-13
6.0 EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN	6-1
7.0 OUTSTANDING POLICY ISSUES	7-1
8.0 ENFORCEMENT	8-1
9.0 RECOMMENDATIONS	9-1
10.0 REFERENCES.....	10-1

Figures

Figure 2-1 Massachusetts Military Reservation
Figure 2-2 Site Location
Figure 2-3 Recently Installed Monitoring Wells and Existing Irrigation Wells
Figure 2-4 Discharge Rate and Downstream Reach on the Coonamessett River
Figure 2-5 Interpreted Area of EDB Discharge to the Surface
Figure 2-6 Geologic Cross-Section A-A'
Figure 2-7 Air Sampling Locations
Figure 5-1 CWSW Decision Tree
Figure 5-2 Location of Public Water Supply Extensions
Figure 5-3 Surface Water Decision Tree
Figure 5-4 Irrigation Well Locations
Figure 5-5 Schedule for Proposed Actions for FS-28 Action Memorandum

Tables

Table 2-1 Irrigation Water Usage Summary for Affected Bogs and Farm
Table 4-1 Exposure Parameters for Calculating Risk Equivalent Concentrations in Surface Water
Table 4-2 Risk Equivalent Concentrations in Surface Water for EDB (µg/L)

TABLE OF CONTENTS

Table 5-1 Irrigation Well Drilling Summary

Table 5-2 ARARs, Criteria, and Guidance for FS-28 Removal Actions

Appendices

Appendix A Response to Comments on Draft Action Memo issued May 2, 1997, Response to Comments on the Draft Final Action Memo Issued June 6, 1997, and Memorandum of Resolution for Comments on the Revised Draft Final Action Memo issued July 8, 1997.

Appendix B Biweekly Discharge Measurements and Biweekly Surface Water Offsite Laboratory EDB Data and Air Sampling Analytical Data

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ACRONYMS AND ABBREVIATIONS

AFCEE	Air Force Center for Environmental Excellence
ARAR	Applicable or Relevant and Appropriate Requirement
AT	Averaging Time
AWQC	Ambient Water Quality Criteria
BW	Body Weight
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CF ₁	Conversion Factor 1 (mg to µg)
CF ₂	Conversion Factor 2 (cm ³ to L)
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
cm/hr	centimeters per hour
CMR	Code of Massachusetts Regulations
CS-4	Chemical Spill No. 4
CSF	Cancer Slope Factor
CWSW	Coonamessett Water Supply Well
DEP	Massachusetts Department of Environmental Protection
DPH	Massachusetts Department of Public Health
ED	Exposure Duration (to Surface Water)
EDB	Ethylene Dibromide
EF	Exposure Frequency (to Surface Water)
EPA	U.S. Environmental Protection Agency
ET	Exposure Time (to Surface Water)
ETD	extraction, treatment, and discharge system
ETR	Extraction, Treatment and Reinjection system
FFA	Federal Facilities Agreement
FS-28	Fuel Spill No. 28
ft/day	feet per day
GAC	Granular Activated Carbon
gpm	Gallons per Minute
HDPE	high-density polyethylene
HWMR	Hazardous Waste Management Regulations

ACRONYMS AND ABBREVIATIONS

IR _i	inhalation rate
IR _w	surface water ingestion rate
IRP	Installation Restoration Program
m ³ /kg	cubic meters per kilogram
MCL	maximum contaminant level
MDL	method detection limit
mgd	million gallons per day
MGL	Massachusetts General Law
mL/hr	milliliters per hour
MMR	Massachusetts Military Reservation
MOA	Memorandum of Agreement
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	nondetect
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List (Superfund)
PC	dermal permeability factor
ppbv	parts per billion volume
PQL	practical quantitation limit
PRP	Potentially Responsible Party
QC	quality control
RCRA	Resource Conservation and Recovery Act
RDA	Request for Determination of Applicability
REC	risk equivalent concentration
RfD	reference dose
RI/FS	Remedial Investigation/ Feasibility Study
RL	reporting limit
RME	reasonable maximum exposure
ROD	Record of Decision
SA	skin surface area
SDWA	Safe Drinking Water Act
SF _i	inhalation slope factor

ACRONYMS AND ABBREVIATIONS

SF _o	oral slope factor
SIM	selective ion mode
SVOC	semivolatile organic compound
SWOU	Southwest Operable Unit
TAT	turnaround time
TCE	trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure
TSD	treatment, storage, disposal
USC	United States Code
USGS	U.S. Geological Survey
VF	volatilization factor
VFD	variable frequency driver
VOC	volatile organic compound
µg/L	micrograms per liter

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PREFACE

This document presents the response actions undertaken for the FS-28 Ethylene Dibromide Plume located south of the Massachusetts Military Reservation (MMR) in Barnstable County, Massachusetts. This Action Memo serves as the primary decision document that substantiates the need for a removal response, identifies the current and proposed actions, and explains the rationale for the response.

Threats to human health, public welfare, and the environment are identified and described. The goal of the response actions for FS-28 is to eliminate or reduce these threats. The proposed response actions eliminate the threats by providing alternate water supplies, treatment of wells located within the plume, and an extraction, treatment, and discharge system for the plume. The threats will be managed by the continued sampling and analysis in the areas impacted. Each of the response actions is presented in this Action Memorandum. Terminology has been revised to indicate a time-critical removal action and a non-time-critical (interim) action(s) for remediation of the threat to public welfare and the environment. The Time-Critical Removal Action is proposed for treatment of the highest concentrations of EDB found in the plume before they can discharge to the Coonamessett River. The objective of the non-time-critical Interim Action is 100 percent capture of the plume upwelling in the Baptiste Bogs to eliminate the surface water risk exposure pathway. In many places, the text references the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998a) which outlines the monitoring being conducted to evaluate the performance and impact of the actions.

Supplemental Action Memos may be required to (1) present the design criteria and preliminary engineering for wellhead treatment of the Coonamessett Water Supply Well (CWSW), (2) present the data compilation from the Time-Critical Removal Action and outline the scope for non-time-critical (interim) actions, and (3) develop and present a water management plan for bog and farm operation.

A draft version of this Action Memorandum was issued May 2, 1997. The Air Force Center for Environmental Excellence (AFCEE) has responded to comments received on the draft document from the Massachusetts Department of Public Health (DPH), the Massachusetts Department of Environmental Protection (DEP), and the U.S. Environmental Protection Agency (EPA). The comments and AFCEE's responses to them are included as Appendix A. A second draft version of this Action Memorandum was issued by AFCEE on June 6, 1997. Responses to this document, which were received on June 20, 1997, and AFCEE's responses to them are also provided in Appendix A. This document has also been revised to reflect the discussions during meetings with the Management Review Group (June 26, 1997) and the Remedial Project Managers (June 30, 1997). A revised draft was issued by AFCEE on July 8, 1997. Responses to comments on the revised draft were resolved on October 23, 1997 and the Memorandum of Resolution is included in Appendix A. Throughout this Final FS-28 Action Memorandum, footnotes are used to indicate where actions have been completed or to note significant changes in project assumptions since the previous version was issued.

1.0 PURPOSE

The purpose of this Action Memorandum is to request and document approval of the response actions that have been previously taken, are in progress, are or planned for the Fuel Spill 28 (FS-28) Ethylene Dibromide Plume located south of the MMR, a National Priorities List (NPL) site in Barnstable County, Massachusetts. Response actions are being managed by AFCEE under the direction of the EPA, as specified in Amendment No. 1 (EPA et al. 1996) to the Federal Facility Agreement (FFA) (EPA et al. 1991). The Massachusetts DEP is not a signatory to the FFA, but is an active participant in the clean-up process and provides guidance and direction to the process through several chartered boards and committees. The proposed response actions are being implemented by the Air Force as a time-critical action to prevent the exposure of the residents of the Hatchville area of Falmouth to EDB, and to prevent the economically important cranberry crop from being impacted by EDB-contaminated groundwater and surface water.

The FS-28 plume was not included in the *Record of Decision for Interim Action* (Stone & Webster 1995) which addressed six of the plumes emanating from the MMR. However, it was included in the amendment to the FFA dated April 24, 1997. In May 1996, AFCEE assumed management of the Installation Restoration Program (IRP) at MMR to manage the environmental investigation and remediation activities. The draft *Strategic Plan* (AFCEE 1996) committed to (1) conducting a field investigation to delineate the leading edge of the FS-28 plume; (2) preparing a technical memorandum to present the findings of the investigation; and (3) making recommendations for action, if necessary, and (4) conducting a complete remedial investigation and feasibility study (RI/FS) to address the entire plume. The *Draft FS-28 Technical Decision Memorandum* (AFCEE 1997a), issued in February 1997, presented the data collected during the EDB RI/FS Data Gap Sampling Field Program, and recommended the following response actions:

- implement surface water and groundwater decision rules by which periodic monitoring data would be used to manage risk;
- connect selected residences to the public water supply;
- evaluate interim response alternatives for remediation options in the southern area of the FS-28 plume.

This Action Memorandum, which describes the time-critical response actions that will be conducted at the leading edge of the FS-28 plume, will become part of a Record of Decision (ROD) for this site when the document is approved by AFCEE and EPA.

The response actions being taken are in most cases conducted at the leading edge of the EDB plume to reduce and eliminate exposures. Public water supply is being provided to all residents within 250 feet of the known plume boundary above the maximum contaminant level (MCL) for EDB. The construction of an extraction, treatment and discharge (or reinjection) system has been divided into a time-critical removal action, a non-time-critical interim action and a final remedy. The final remedy will be completed in conjunction with the Southwest Operable Unit (SWOU) RI/FS. This Action Memorandum specifically addresses the Time-Critical Removal Action.

2.0 SITE CONDITIONS AND BACKGROUND

The MMR (Figure 2-1) has been used extensively by several military organizations dating back to the 1930s when the base was first built. Most of the industrialized activities associated with the military occurred in the southern portions of the base. Runways, aircraft, vehicle fueling and maintenance, landfills and firefighter training were in operation to support the military.

The heaviest military activity was from 1940 to 1946 by the U.S. Army, and from 1955 to 1972 by the U.S. Air Force. The use of petroleum fuel products and industrial solvents, as well as the generation of hazardous waste material were at a height during these periods. It was common practice for many years to dispose of such wastes in landfills and drywells, and to use them at firefighter training areas. Contaminants such as fuels and solvents were released to the unsaturated sands (approximately 30 to 60 feet thick). When these products reached the top of the water table, they created groundwater plumes of dissolved organic compounds.

MMR resides on top of the recharge area for the sole-source groundwater aquifer from which all the four surrounding towns draw municipal drinking water. With an average groundwater flow rate of 1 to 2 feet per day, some of the plumes of contaminated groundwater emanating from the MMR extend to lengths of more than three miles.

In 1992, EDB was discovered in groundwater in the vicinity of the leading edge of the Chemical Spill No. 4 (CS-4) plume. Subsequently, there have been several investigations to delineate the extent of EDB south of the CS-4 extraction fence. The plume was officially given a designation as FS-28 in November 1996.

2.1 SITE DESCRIPTION

The findings of the field investigation, presented in the *Draft FS-28 Technical Decision Memorandum* (AFCEE 1997a), determined that the leading edge of the FS-28 plume is discharging into the surface waters of the Coonamessett River and associated wetlands, including cranberry bogs, south of Hatchville Road in Falmouth. The

groundwater flow, and therefore the migration of EDB, is strongly controlled by the Coonamessett River, which increases significantly in discharge along the stretch where EDB is upwelling. Numerical groundwater modeling indicates that the EDB plume will continue to discharge to the Coonamessett River and that the plume is effectively captured within the river valley. Most of the plume is upwelling in the bogs north of Thomas Landers Road. However, a small portion of the leading edge of the plume migrating in the subsurface will likely discharge further downstream.

2.1.1 Removal Site Evaluation

The proposed response actions will mitigate the potential risk to human health and the environment at the leading edge of the FS-28 plume. Additional sampling and analysis will be conducted during the Southwest Operable Unit Remedial Investigation planned for 1998.

Some of the monitoring proposed in this Action Memo (e.g., monitoring well and surface water sampling and analysis) is included in the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998a). The Monitoring Plan includes specific analytical sampling procedures that will not be reiterated in this Action Memorandum. Air monitoring, which was not included as an investigative task in the Monitoring Plan, has been conducted to evaluate the threat of airborne EDB exposure. Because the *Draft FS-28 Technical Decision Memorandum* (AFCEE 1997a) provides a detailed site description, a site conceptual model, and the physical and chemical characteristics, these will not be discussed in detail here.

The FS-28 plume, which is currently assumed to be related to past activities at MMR, has migrated south approximately four miles where it discharges by upwelling into the Coonamessett River. Potential impacts of the plume are discussed in Section 3.

2.1.2 Physical Location

The MMR is located on Upper Cape Cod, and is bordered by the towns of Bourne, Falmouth, Mashpee, and Sandwich. The upgradient extent of the FS-28 plume, as

currently mapped, is located in the Crane Wildlife Management Area, which is south of the MMR in Falmouth. The plume has a north-south orientation, is bounded on the east by Coonamessett Pond, on the west by Deep Pond, and extends to a point south of Hatchville Road in Falmouth. The leading edge of the plume is narrow, and is located off Thomas Landers Road. The plume axis at the toe generally parallels and is coincident with the Coonamessett River, which flows south from the western arm of Coonamessett Pond to a tidal estuary, Great Pond, south of Route 28 in Falmouth.

The location for the actions discussed in this memorandum extends from the Falmouth Coonamessett Water Supply Well (CWSW), located south of the western arm of Coonamessett Pond, to the intersection of the Coonamessett River and Route 28 (Figure 2-2).

2.1.3 Site Characteristics

The physical characterization of the FS-28 plume site has been interpreted from data collected from more than 30 borings drilled in the study area (AFCEE 1997a). The locations for monitoring wells recently installed in the southern portion or lower area of the FS-28 plume are shown in Figure 2-3.

Measurements by AFCEE and the U.S. Geological Survey (USGS) indicate that the Coonamessett River does not gain much water along the reach from its origination point at Coonamessett Pond to the point where it crosses Hatchville Road. Where the river leaves Coonamessett Pond, streamflow measurements have varied between 1.11 and 3.87 cubic feet per second (cfs) (Appendix B).

The streamflow data also indicate that there is significant discharge from the aquifer to the river (increase in river flow) between Hatchville Road and Thomas Landers Road. This recharge of water is coincident with a strong upward gradient near the river, as evidenced in nearby well clusters such as 69MW1285. Figure 2-4 shows the discharge measurements collected at five locations along the river during two sampling events in March 1997. The increase in flow between Hatchville and Thomas Landers roads can

be seen on the graphs of discharge versus downstream reach as an increase in slope between locations 69SW0006 and 69SW0046.

The cultivated bogs are typically flooded in late November to early December to prevent frost damage to the cranberry vines. Due to an unusually warm winter (1996/1997), bogs were flooded from mid-December 1996 to mid-February 1997. During flooding, the Coonamessett River is dammed up, raising the water level from 0.5 to 3 feet over the area of the cultivated bogs. Due to increased hydrostatic pressure, upward vertical gradients are reduced under flooded conditions, which keeps the groundwater from moving into the bogs. Discharge measurements were taken biweekly for three months at five locations along the Coonamessett River (Appendix B). On average, the discharge decreased from 1 to 4 cfs at measurement locations during the period when bogs were flooded due to the decrease in the upward vertical gradient caused by flooding.

Approximately 68 acres of agricultural crops south of Hatchville Road are irrigated from either groundwater wells or surface water. Table 2-1 presents a summary of the agricultural water usage for the affected bogs shown on Figure 2-1. AFCEE has contacted all of the bog owners and other agricultural users of the Coonamessett River to discuss their irrigation practices. In the spring, the irrigation of cranberry bogs begins near the middle of April when the night temperatures are anticipated to be lower than 32°F. For frost control, spray irrigation is conducted from about 11 p.m. to 9 a.m. and continues as needed until mid-June. From mid-June to October, the fields are irrigated as needed from 5 a.m. to 7 a.m. to provide at least 2 inches of water on the crop per week. Typically, spray irrigation is conducted three times during the week. During the fall, the bogs are either harvested dry or wet. The Baptiste Bogs, where EDB has been found upwelling, are dry-harvested since there is typically not sufficient water flow in the river to flood the bog. Furthermore, discussions with the cranberry growers in the Coonamessett River Valley revealed that the Thompson and Adams bogs are also dry-harvested. The Chaston, Augusta, Reservoir, Middle and Lower bogs

are wet-harvested. The Chaston and Augusta bogs have never been harvested. Water used for flooding of the Reservoir, Middle and Lower Bogs is derived from Pond 14.

Other agricultural crops affected by the surface water contamination are strawberries and vegetables. The farmer of these crops draws surface water from Pond 14 for frost protection and irrigation¹. In 1996 the farmer utilized approximately one million gallons of water during the six-month growing season. Frost control is typically conducted after mid-May for strawberries when the air temperature drops below 44° F. Routine irrigation occurs during the growing season, as needed to supplement rainfall.

The cranberry growers utilize both ground and surface waters to grow and harvest their crops¹. An existing irrigation well (69IG0001), which is located south of the two most northern bogs, is screened in the EDB plume and thus extracts contaminated water when the well is in service for irrigation. The lower bogs utilize surface water intakes for both frost protection and irrigation¹. The studies to date indicate that the EDB plume upwells in the upper part of the lower Baptiste bogs (Figure 2-5) and flows into the Coonamessett River (AFCEE 1997a). Figure 2-6 presents a cross-section of the FS-28 plume upwelling into the bogs south of Hatchville Road. This upwelling results in detectable concentrations of EDB in the Coonamessett River as it flows through the lower bogs. The EPA, DEP, and Massachusetts Department of Public Health (DPH) have determined that the use of EDB-contaminated surface and ground waters for agricultural purposes presents an unacceptable risk to public health and the environment.

The FS-28 plume is migrating to the surface south of Hatchville Road (AFCEE 1997a), moving through advective transport with the groundwater, which is flowing south and rising slightly to discharge in the Coonamessett River. The average linear velocities of groundwater flow range from 0.02 to 0.2 feet per day (ft/day) for silty sands, and range

¹ In 1997 AFCEE installed 9 irrigation wells to replace the irrigation surface water supply points along the Coonamessett River and Pond 14.

from 0.2 to 2 ft/day for outwash sands (AFCEE 1997a). Various numerical groundwater models that simulate the FS-28 plume transport have predicted that the discharge location for the EDB is the Coonamessett River. These models show that, in general, most of the EDB migrates to the surface waters of the Coonamessett River north of Sandwich Road, and the rest of the plume continues to migrate in the subsurface, very close to the river, eventually surfacing at points along the length of the river north of Great Pond.

2.1.4 Release Or Threatened Release of Contaminants into the Environment

EDB is the primary contaminant of concern in the FS-28 plume; it is also the most prevalent organic compound detected in samples collected in the FS-28 sampling program. The maximum detected concentration of EDB (by low-level analytical method 504²) was 16 micrograms per liter ($\mu\text{g/L}$) in samples of deep groundwater just south of Hatchville Road. The concentrations of EDB in the shallow groundwater and surface water are not as high as those in the deep groundwater. In addition, the concentrations in the shallow groundwater are higher than the concentrations in the surface water where EDB is discharging to the surface. The concentrations of EDB in the Coonamessett River decrease downstream. The highest concentrations of EDB detected in the surface water and shallow groundwater are $0.36 \mu\text{g/L}$ ³ and $3.9 \mu\text{g/L}$, respectively. Shallow groundwater samples were taken just into the groundwater table. Appendix B includes a summary of analytical EDB data of biweekly samples of surface water.

At the CWSW site, EDB has been detected at concentrations of $0.23 \mu\text{g/L}$ in samples collected from an adjacent well screened approximately 195 feet below the bottom of the supply well screen (AFCEE 1997a). Although samples collected monthly from the supply well have not contained EDB above detection levels, a granular-activated

² The VOC analysis (method 524) of this sample indicated that it contained $18 \mu\text{g/L}$ of EDB.

³ The 1998 Southwest Operable Unit (SWOU) RI detected up to $0.73 \mu\text{g/L}$ of EDB in the irrigation ditches.

carbon (GAC) wellhead filtration system has been installed and is operating to filter water from the supply well as a precautionary measure.

Toluene was detected in one shallow groundwater sample at 35 µg/L, and 1,1-dichloroethene was detected at 2.3 µg/L in another. These were the only compounds other than EDB that were detected in the shallow groundwater samples. The monitoring well data (AFCEE 1997a) indicate that low levels of other volatile organic compounds (VOCs) may be present in monitoring wells southeast of Coonamessett Pond. Toluene was detected in 12 wells, ranging from 0.081 to 15 µg/L. Trichloroethylene (TCE) was detected in five wells, ranging from 0.2 to 1.1 µg/L. These VOCs may be associated with the FS-28 plume; however, a strong correlation has not been established.

Chloroform was detected in five wells, ranging from 0.3 to 1.4 µg/L. Low concentrations of chloroform have also been detected in many of the private wells in the area. The chloroform is not believed to be associated with the FS-28 plume, but exists at low levels in the groundwater. Background manganese concentrations also appear to be slightly higher in the area, but manganese is not considered a contaminant of concern. Six of the wells near the leading edge of the FS-28 plume (not all of which are screened within the plume) have shown lead concentrations higher than the tap water action level of 15 µg/L. It is not clear whether there is a correlation between the lead and the EDB, or where the lead is coming from, since it is generally immobile in groundwater systems. Low concentrations of bis 2-ethylhexyl-phthalate and di-N-butyl phthalate were detected in three wells; however, these semi-volatile organic compounds (SVOCs) are not considered to be contaminants of concern.

Because EDB is found in the surface waters of the two rivers and bogs, there is a potential for release to the air and exposure to the nearby residents on Little John Road and Thomas B. Landers Road. Modeling has been conducted by DPH which shows that there is the possibility of adverse effects from long-term exposure to EDB in ambient air at some locations downwind of the bogs and reservoirs under some

conditions. However, the DPH concluded that short-term opportunities for exposure to EDB in the air around the bogs and reservoirs (e.g., from flooding the bogs for a limited number of seasons) were not expected to result in adverse health effects; but it is unknown how long there have been opportunities for past exposures. Recent air sampling results may be used in the DPH model.

2.1.5 National Priorities List Status

The Massachusetts Military Reservation was added to the National Priority List in 1989, designating that the contamination at the base was a serious threat to the public and environment, and required EPA oversight.

2.2 OTHER ACTIONS

Several actions have already been taken to mitigate the risk of exposure to EDB in the FS-28 plume. The actions discussed below have already been taken or are ongoing. Ongoing actions which are planned to continue with or without modification will also be discussed in Section 5.

2.2.1 Previous Actions

Investigation activities, such as borewater sampling, groundwater monitoring well installation and sampling, surface water and sediment sampling, aquifer testing, water level surveying, and river discharge monitoring, conducted at the site are discussed in the *Draft FS-28 Technical Decision Memorandum* (AFCEE 1997a). Other actions have included the following:

- installation and maintenance of a wellhead treatment system to protect Falmouth's CWSW from FS-28 contamination;
- providing residents with bottled water and information about the EDB contamination in the Hatchville area;
- conducting a private well sampling and analysis program for residents in the area.

- collecting air samples for EDB analysis in the area surrounding Broad River where the highest surface water concentrations of EDB have been found since the testing program was initiated.

The water pumped from Falmouth's Coonamessett supply well is filtered by a GAC system that was installed by AFCEE and placed in service in June 1996. The GAC filter system includes a concrete foundation, a temporary enclosure for freeze protection, a new pump with a variable frequency driver (VFD) motor, motor control center, associated supply and discharge piping, and a security fence. The filtered water produced from the CWSW (at 700 gallons per minute) is critical to the town's water supply system, especially during the peak demands of the summer tourist season.

In October 1996, when EDB was discovered to have migrated further south than was previously determined, water samples were collected and analyzed from 56 residences with private wells. At the same time, bottled water was made available to residents in the potentially affected area. As the nature and extent of the leading edge of the plume was better defined, a biweekly program was developed and implemented to monitor the private wells nearest the plume.

Trace levels of EDB were detected in two residential well samples collected May 6, 1997, and are considered estimated results because they were well below our reporting limit (RL) of 0.01 µg/L, but were above the laboratory's method detection limit (MDL) of 0.006 µg/L. MDL is defined as the "minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero" (40 CFR; part 136; Appendix B). MDL studies reflect "ideal" instrument operating conditions and frequently have values that are lower than the laboratory and instrument can confidently report in environmental samples. The practical quantitation limit (PQL) or reporting limit (RL) is defined by AFCEE (AFCEE 1998d) as "the lowest level that can be reasonably achieved within specified limits of precision and accuracy during routine laboratory operations." The PQL should be considered a routinely achievable detection limit with a relatively good certainty that any reported value is reliable. In most cases, analytical laboratories

report to PQL and not MDLs. When values at concentrations between the MDL and PQL are reported, the data are "J" flagged to indicate that the results are estimated.

All associated laboratory and field QC criteria were reviewed in detail and were acceptable for the analysis of the above samples. The individual sample results and chromatograms were reviewed and checked for assurance that EDB was correctly identified and quantitated. The required laboratory QC criteria were met for these samples. Although all QC criteria were met, the levels of EDB detected in these samples could possibly be a laboratory artifact from the instrument or equipment.

Four air samples were collected for EDB analysis⁴. An initial sample was collected from near the surface of Broad River on May 14, 1997. Another three samples were collected on May 29, 1997, from the previously sampled location near the surface of Broad River, a crosswind location, and a downwind location (Figure 2-7). The air samples were analyzed for EDB by Method TO-14 (SIM).

The Broad River was selected as an air sampling site because the highest concentrations of EDB in shallow groundwater and surface water samples have been detected in or surrounding Broad River. Because of its relatively large surface area, this location was also selected for air sampling because it has the highest potential for the release of EDB from water to air. A surface water sample will be collected at the same place and time and analyzed for EDB by method 504.1. The locations for the crosswind and downwind locations were based on historic prevailing wind direction records measured at Otis Air National Guard Base, and field measurements of wind direction taken prior to sampling.

The May 14 sample showed an estimated 0.0020 ppbv (parts per billion volume) of EDB; however, this sample is not considered valid because a laboratory blank

⁴ A total of 18 samples have now been collected from the Broad River area. Results of all air and associated water samples are presented in Appendix R2 of the Draft SWOU RI Report (AFCEE 1998b).

contained approximately 0.00093 ppbv of EDB. None of the three samples collected on May 29 had concentrations of EDB above the detection limit of 0.002 ppbv. These results are included in Appendix B and were presented in a weekly technical update meeting with the stakeholders. The air test results have also been submitted to the DPH for review. Additional air sampling will be conducted, as discussed in Section 5.1.1.3.

2.2.2 Current Actions

The following actions are ongoing :

- AFCEE is conducting periodic sampling of groundwater and surface water (as presented in the *Draft Final FS-28 Monitoring Plan*, AFCEE 1998a) to monitor potential threats to human health and the environment. This sampling includes monitoring EDB concentrations in and upgradient of the CWSW, in the river, in irrigation water, and at the leading edge of the plume.
- AFCEE is currently providing operational support for the GAC at the CWSW wellhead. A preliminary design is being completed for the treatment system that will be turned over to the town of Falmouth for final design and construction. The wellhead treatment will continue as long as the well continues to be utilized by the town.
- AFCEE provided bottled water and biweekly well sampling to over 35 residences prior to connecting them to the public water supply. A total of 125 residences were connected to the public water supply.
- AFCEE is planning to implement non-time-critical (interim) actions in 1999.
- AFCEE is conducting the Southwest Operable Unit RI/FS, which includes the FS-28 plume.

2.3 ROLE OF STATE AND LOCAL AUTHORITIES

Both the Commonwealth of Massachusetts and the town of Falmouth are providing assistance to the Air Force in planning and conducting ongoing and the proposed removal actions. The Massachusetts DEP and DPH have advised AFCEE of the potential risks resulting from exposure to EDB-contaminated ground and surface waters, and the potential volatilization of EDB into the atmosphere from surface waters and spray irrigation. As directed by the National Oil and Hazardous Substances

Pollution Contingency Plan (NCP) and the FFA (under CERCLA §120), the EPA is the lead agency for oversight of investigative and remedial actions performed at MMR (EPA et al. 1991, 1996). The Commonwealth and representatives from four surrounding towns serve in an advisory capacity to the EPA.

The town of Falmouth owns most of the land in the affected area south of Hatchville Road where the bogs are located. The land is leased on a long-term basis by the Falmouth Conservation Commission to a cranberry grower. The Conservation Commission has granted rights of access to the bogs and adjacent land to the Air Force and its contractors to conduct removal activities. Several other bogs along the Coonamessett River are privately owned and operated.

The town is also assisting AFCEE in the extension of water supply mains in Hatchville. The town is managing the connection of the 125 residences and one business to the mains, and providing oversight of construction and design assistance. The Air Force is reimbursing the town for its expenses. The town has also provided technical assistance during the design and construction of the GAC system at the CWSW, and continues to assist AFCEE in operation and maintenance of the GAC system.

2.3.1 State and Local Actions to Date

Various Commonwealth and local agencies have written letters concerning EDB to EPA and AFCEE since 1996. The following is a summary of the Commonwealth actions:

- The Massachusetts DEP issued a letter dated February 22, 1996, directing that the CWSW be shut down until wellhead treatment was installed. Since the Coonamessett well comprises nearly 20 percent of the town's total water supply, it is needed to meet the summer tourist demand. Wellhead treatment was installed and operational by July 1996, and the state gave conditional approval for its use in the public water supply system.
- DPH issued a letter to AFCEE in November 1996, concerning, the degradation of EDB to vinyl bromide. AFCEE completed a method detection limit study for vinyl bromide and the contract laboratory was able to detect vinyl bromide at 0.01 µg/L. The contract laboratory has not detected any vinyl bromide in samples taken from

the FS-28 plume. Vinyl bromide has been added to the standard suite of analysis and all samples continue to be evaluated for vinyl bromide.

- DPH issued a letter to AFCEE in December 1996, concerning the flooding of the cranberry bogs for winter protection. AFCEE prepared a risk assessment that showed limited risk from flooding of the bogs. DPH used this risk assessment and other information to conclude that flooding the bogs over the winter would not present a public health concern. DPH asked AFCEE to identify homes that had experienced flooding and to take steps to prevent this from happening. AFCEE identified one home that could be flooded, and completed sampling beneath the basement, and sealed the open hole in the concrete foundation. AFCEE also installed piezometers between the home and the river to determine the depth of the water table during flooding.
- DPH issued a letter to AFCEE dated March 6, 1997, concerning possible inhalation exposure during spray irrigation and other bog operations. DPH requested the establishment of an aggressive on-going environmental monitoring program for water, air, and cranberry fruit. In response, AFCEE issued a letter to DPH on March 26, 1997, providing an outline of the proposed sampling and remedial actions to be performed in the cranberry bogs surrounding the Coonamessett River where EDB is discharging to the surface.
- Representatives from the Massachusetts Senate issued a letter to AFCEE on March 19, 1997, requesting action be taken to protect the human health as well as the agricultural crops along the Coonamessett River Valley.
- Following a review of the AFCEE plan submitted on March 26, 1997, DPH issued a letter to AFCEE dated April 7, 1997, which outlined areas of the proposed plan that DPH felt did not adequately address uncertainties regarding the distribution of and the risk from EDB in the cranberry bogs. Furthermore, DPH reiterated its position on supplying alternate water supplies to the agricultural growers along the river.
- A Notice of Responsibility was issued by the DEP on April 19, 1997, which directed AFCEE to do the following:
 - Assess the current and future impact of EDB-contaminated groundwater to the cranberry bogs along the Coonamessett River, including the soil, vines, fruit, and cultivation.
 - Immediately provide a source of clean, uncontaminated irrigation water for the affected bogs, and take steps to eliminate all EDB pathways through the contaminated irrigation wells.
 - Provide a clean source of irrigation water for all downstream and downgradient users of irrigation water.
 - Install an extraction, treatment, reinjection (ETR) system to capture and clean EDB-contaminated groundwater and surface water prior to discharge to the Coonamessett River, including but not limited to any affected surface waters in the affected bog areas. The groundwater remediation goals shall be 100-percent

capture and cleanup of the plume, and treatment of contaminants to background levels, if technically and economically feasible.

- Conduct weekly monitoring of irrigation well water and surface water.
- Conduct continuous ambient air monitoring at the affected bogs and reservoirs.

Since September 1996, AFCEE has provided information weekly to the Falmouth Conservation Commission concerning the expedited groundwater investigation. The Conservation Commission on several occasions has granted emergency approval to install monitoring wells, irrigation wells, and an extraction well within 200 feet of the river. AFCEE has also obtained approval, with conditions from the Conservation Commission, to discharge treated water to within 50 feet of the river. Soil cuttings from the well installations within 200 feet of the river are required to be containerized and transported back to MMR for disposal. Due to the large extent of the investigation and remedial activities, a Request for Determination of Applicability (RDA) application, which outlined the investigation activities near the ponds and river, was submitted on November 14, 1996, by AFCEE. Emergency certification was granted by the Conservation Commission on November 21, 1996, to continue the installation of monitoring wells south of the Coonamesett Pond.

AFCEE also received approval from the Conservation Commission to construct temporary infiltration basins for the discharge of development water from the irrigation wells. Conditions of the approval include providing erosion protection and maintaining at least a three-foot separation above the groundwater table.

AFCEE submitted a Notice of Intent (NOI) application for the work involved with the two river crossings for the water main extensions on Hatchville Road and Thomas B. Landers Road; AFCEE also submitted an RDA for the power lines which need to be brought in to the site for the extraction, treatment, and discharge (ETD) system. Wetlands and other critical habitat within 500 feet of the proposed alignments have been identified, and a delineation of these were submitted as part of the NOI and RDA. The NOI and RDA were prepared in accordance with state and local guidance;

however, since the alternate water and ETD system actions are being taken as CERCLA response actions, no permits are required, as specified in the NCP.

A memorandum of agreement (MOA) was signed between the town of Falmouth and Jacobs Engineering (the lead remediation contractor for AFCEE at MMR) on April 29, 1997, concerning the residential hookups for over 85 residences and one commercial business in the Hatchville area. The MOA describes the work to be completed by the town in connecting the over 85 users and eliminating their private wells. Through Jacobs Engineering, the Air Force is reimbursing the town for its expenses for construction oversight, the connections to the water mains, and the administrative costs. One of the requirements of the agreements is that all private wells replaced by the alternate water source be abandoned. The wells will be either pulled or grouted in place in accordance with Falmouth Board of Health requirements.

2.3.2 Potential for Continued State and Local Response

Both the Commonwealth and the town of Falmouth actively participate on numerous committees, boards and groups (including the Senior Management Board, the Management Review Group, the Process Actions Teams, and the Technical Review and Evaluation Team) that have been formally chartered to ensure that the concerns of affected communities and the state are addressed by the Air Force's response activities. It is assumed that both the state and the town will continue their current involvement.

AFCEE will submit an NOI for the work required to install a year-round groundwater extraction, treatment, and discharge (or reinjection) system. The interim action will likely require a NOI since the treatment system will be within 200 feet of the river and wetlands. Emergency certification may be approved for the time-critical removal action with the condition that a NOI be submitted and any site features be removed if they are not part of the interim action or final remedy.

DPH, in conjunction with the DEP and Department of Fish and Wildlife, has developed a sampling and analysis protocol for shellfish that may have been exposed to EDB.

The protocol has been reviewed, and the first of two sampling rounds was conducted in May 1997. The final shellfish sampling round is scheduled for August 1997. DPH is also planning to sample cranberry fruit prior to the autumn harvest.

Furthermore, AFCEE intends to replace surface water users of the Coonamessett River with alternate water supplies. Several of the bogs require withdrawals from the aquifer to meet the requirements of the Massachusetts Water Management Act Program. Since the response action is being taken under CERCLA, no permit is required for the irrigation wells. However, when the ownership of the wells is transferred to the growers, permitting may ultimately be required.

3.0 THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

Section 104 of CERCLA and Section 300.415 (b)(2) of the NCP identify the criteria that must be considered in determining the appropriateness of a contaminant removal action. If the current or potential impacts meet the criteria and warrant appropriate removal actions, the actions must minimize, stabilize, mitigate, or eliminate the threat of the release of a contaminant of concern to the environment. The following paragraphs address the threats to public health or welfare and the environment.

3.1 THREATS TO PUBLIC HEALTH OR WELFARE

The impacts of the FS-28 plume on public health or welfare that would be addressed by removal action are as follows:

- potential contamination of the Falmouth CWSW, which is screened within the lateral plume extent, although the well is screened (vertically) above the plume;
- potential contamination of private water supply wells screened within the lateral extent of the EDB plume in the Hatchville area;
- potential exposure of agricultural workers involved in the growing and harvesting of cranberries in the bogs along the Coonamessett River which flows through the Hatchville area;
- potential exposure of Hatchville residents from the spring spray irrigation of the cranberry bogs and the flooding of the bogs during the fall and winter;
- potential economic impacts resulting from the exposure of the cranberry fruit to EDB-contaminated water, as stated in the April 15, 1997, letter from John P. DeVillars, Regional Administrator, EPA Region I. It should be emphasized that the vines and fruit are not exposed to the Coonamessett River. Typically, the bog operators try to keep the water level at least 16 inches below the plants. The only time the plants would be impacted is during flooding or spray irrigation.

3.2 THREATS TO THE ENVIRONMENT

The impacts of the plume on the environment have not been fully characterized. The proposed removal actions will reduce the discharge of EDB to surface waters and preclude the use of contaminated surface water for spray irrigation and flooding. The potential impacts to the environment that will be reduced by the removal actions

include potential impacts to the estuarine and marine environments since the river discharges directly into Great Pond, and potential impacts to the ecological receptors residing in the bogs along the Coonamessett River.

4.0 ENDANGERMENT DETERMINATION

An endangerment determination was made in the Draft Final Action Memorandum (AFCEE 1997c) which consisted primarily of deriving site-specific risk equivalent concentrations (RECs) for human exposure to EDB in surface water. Subsequently, a baseline risk assessment for this area was completed for the Draft SWOU RI (AFCEE 1998b). A summary of that risk assessment is presented here. Additionally, the RECs for surface water EDB have been recalculated using exposure parameters consistent with the draft RI (Table 4-1), except that a fish ingestion scenario was included using a bioconcentration factor for EDB in fish equal to 10 mg/kg wet fish per mg/L water. A more detailed discussion of the risk assumptions and calculations is presented in the SWOU RI (AFCEE 1998b).

The risk of exposure to EDB in surface water and sediment exceeded guidance risk thresholds (1×10^{-6} excess cancer risk) for wading scenarios for adults and children, fishing scenarios for adults, and a work-related exposure scenario for adult cranberry workers. Swimming scenarios for the Coonamessett River were not included due to the shallow depth of the river. Risks from exposure to EDB in groundwater were also found; however, there are no known remaining residences that continue to use groundwater following the installation of public water lines.

The maximum exposure frequency was assumed to be 350 days per year for fishing, 104 days a year for wading, 60 days a year for swimming, and 12 days a year for cranberry workers. The exposed dermal surface area was assumed to include the hands, forearms, and lower legs for wading adults, cranberry workers, and children. The assumed exposure time was 1 hour a day for wading and 8 hours a day for cranberry workers.

To evaluate the relative importance of the various exposure pathways, RECs were calculated with three exposure pathways (surface water ingestion, dermal absorption, and inhalation) for each scenario (i.e., wading, working in a bog, and fish ingestion) (Table 4-2).

The decision tree referenced in Section 5.0 utilizes the 10^{-4} , 10^{-5} , and 10^{-6} RECs for an integrated receptor. The integrated receptor is a combination of the cranberry worker, child wader, adult wader, and adult fisher.

5.0 PROPOSED ACTIONS AND ESTIMATED COSTS

Proposed actions included in this action memorandum are of two types. One type involves actions that directly reduce the risk to human or ecological receptors. The other type involves sampling and analysis programs that will be used for risk management.

5.1 PROPOSED ACTIONS

The proposed actions to mitigate or manage risk from potential EDB effects on Falmouth's water supply well and the risk of EDB discharge to the surface environment along the Coonamessett River are as follows:

- Continue operation, maintenance, and performance monitoring of the wellhead filtration at the CWSW and continue to develop the final design for a permanent treatment system that includes iron removal.⁵
- Continue to provide bottled water to, and analyze for EDB in tap water samples collected from 35 residences in the vicinity of the FS-28 plume on a biweekly basis until the homes are connected to public water. Extend the town water mains and connect residences located within 250 feet of the lateral extent of the FS-28 plume.⁶
- Conduct environmental monitoring to evaluate and manage the human health risk from EDB exposure.⁵
- Provide the necessary electrical power and associated equipment to operate a groundwater extraction, treatment, and discharge system. The time-critical removal action entails extracting water from the extraction well (69EW0001), treatment by a granular-activated carbon unit located in the bog, and discharge to the river. The system will operate continuously; the goal of the removal action is to provide hot-spot removal of the highest concentration of EDB and to capture a large portion of the plume at Hatchville Road. The secondary objective of the well is to provide hydraulic and ecological impact data that will be used to design the non-time-critical (interim) action. Performance monitoring sampling will be conducted from the GAC influent and effluent, surrounding groundwater monitoring wells and surface water stations. Treated water extracted from 69EW0001 will be used as needed for irrigation by the bog operator.⁷

⁵ This action is also included as a non-time-critical (interim) action (AFCEE 1998e).

⁶ This action has been completed. A total of 125 residences were connected to town water.

- Evaluate the performance monitoring data from the removal action, conduct numerical groundwater modeling, and prepare the preliminary design for the interim action. The goal of the non-time-critical (interim) action is to capture 100 percent of the plume before it upwells into the Baptiste bogs.⁷
- Prepare and implement the ecological sampling and analysis plan to evaluate the impacts of the system on the environment⁸.
- Work with the Cape Cod Cranberry Growers Association, DPH, EPA, DEP, and the Falmouth Conservation Commission to develop a plan for autumn flooding that will take practical and available precautions to minimize the contact of cranberries with EDB-contaminated water⁹.
- Install irrigation wells to supply agricultural users of Coonamessett River water with uncontaminated water for cultivation, harvesting, and frost protection of crops. Performance monitoring will be conducted to ensure that no detectable concentrations of EDB are present in irrigation water¹⁰.

The following section describes each of the actions that have been or will be undertaken by AFCEE.

5.1.1 Proposed Action Description

This section outlines the actions that will be taken to mitigate human health and the actions that will be taken to evaluate and manage risk to the environment. Sampling will be done to evaluate the distribution of EDB in the groundwater, surface water, air, and sediment in the vicinity of the cranberry bogs where the FS-28 plume is discharging to the surface environment. The periodic monitoring of surface and groundwater is designed to take advantage of the existing and newly installed wells and surface water stations downgradient of the plume, and to use these points to provide an early warning if downgradient receptors are threatened by changes in the nature or the extent of EDB contamination. The *Draft Final FS-28 Monitoring Plan* (AFCEE

⁷ These actions were completed in 1998.

⁸ The ecological impact monitoring is outlined in the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998b).

⁹ Providing agricultural users with a clean water supply is also an objective of the non-time-critical (interim) action.

¹⁰ Nine irrigation wells were installed in 1997, and the continued monitoring of these is outlined in the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998b).

1998a) summarizes the environmental monitoring that will be completed to evaluate the performance and impacts of the proposed and ongoing actions.

5.1.1.1 Operation and Maintenance of the CWSW Wellhead Treatment System

The continued activities at CWSW include the following: engineering a permanent treatment to eliminate (or reduce) the carbon fouling; monthly sampling and analysis of the raw water; and disinfection of the well and carbon system.

The ongoing design task includes establishing criteria for the design of a permanent system, preparing an outline of specifications for a building to house the treatment system, and making recommendations for a pre-treatment system to control fouling of the beds. Final design and construction of a permanent system may be completed by the town of Falmouth, with funding provided by the Air Force. Operation and maintenance of the current GAC will continue as long as the water supply well is being used by the town.

As summarized in the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998a), the raw water supply and three sentry wells are sampled on a monthly basis for EDB. Figure 5-1 presents a decision tree for determining the responses to be taken depending on the data collected. Actions will be taken in accordance with the decision tree presented in Figure 5-1.

At a minimum, the regulatory agencies (EPA, DEP, and DPH) and the town of Falmouth will be informed of the monthly sampling results as soon as they are received and validated.

5.1.1.2 Residential Well Sampling and Public Water Supply Replacement

Due to the presence of EDB in shallow groundwater, a residential well sampling program was initiated in October 1996. Bottled spring water was provided to 43 residents for a period of seven months. A total of 56 residences were sampled initially for EDB and VOCs. As a precautionary measure, 36 homes with private wells at or

near the mapped extent of the FS-28 plume were placed on a sampling program and have been sampled for EDB every two weeks since October, 1996¹¹. One resident on Thomas Landers Road has been sampled weekly. AFCEE will continue sampling and providing water to the 36 homes until the residences are connected to public water.

To mitigate the potential risk of EDB reaching residential wells in the future, residents on parts or all of Hatchville Road, Ranch Road, Boxberry Hill Road, John Parker Road, Route 151, Ranch Road, River Hill Road, Thomas B. Landers Road, Cranberry Lane, Hunky Dory Lane, and Atamansit Road (Figure 5-2) will be connected to a public water supply and will have their private wells properly abandoned. Water mains are being extended on all of the streets with the exception of John Parker Road and Cranberry Lane. A water main and curbstops already exist on these streets; the homes will be provided with a service line to the main. A total of 125 properties will be connected to the public water supply.¹²

Additional areas are being added into the replacement program; these include Boxberry Hill Road (west of Hatchville) and Strand Way. Thirty-three additional residents will be provided public water supply. The water main will not be extended along Route 151 west of the movie theater, as there are no residences to receive water.

5.1.1.3 Environmental Monitoring

Environmental monitoring includes both surface water and groundwater locations. The purpose of the monitoring is to manage risk and to measure the performance of the remediation systems. Because of the upwelling of EDB in the Baptiste Bogs, surface water measurements both upgradient and downgradient of the bog play an important role.

¹¹ The residential well sampling program around the FS-28 plume is complete since all these residences have been connected to public water.

¹² This action has been completed.

Concentrations of EDB in surface water samples collected since October 1996, have ranged from non-detect to 0.36 µg/L¹³. Evaluation of the data collected to date indicates that there is a correlation between the discharge rate and the concentrations of EDB detected at certain locations. Sampling and analysis will continue so the changes in surface water concentrations of EDB over time can be better understood and the potential risk to human health and the environment can be managed. Periodic sampling at surface water stations along the Coonamessett River is outlined in the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998a). Surface water samples will be analyzed for field measurements of pH and dissolved oxygen and laboratory analysis of EDB.

A decision tree has been developed by which the measured surface water concentrations are compared to several risk-based reference concentrations and linked to appropriate response actions that will be followed to manage the associated risk to human health via exposure to EDB in surface water. The reference concentrations in the decision tree (Figure 5-3) were developed for a receptor who works and resides in the cranberry bogs.

At four of the sampling locations (69SW0058, 69SW0006, 69SW0046, and 69SW0049), river stage and velocity measurements will be taken to monitor the changes in discharge along the length of the river.

In addition, the groundwater will also be routinely assessed at the leading edge and within the plume. The *Draft Final FS-28 Monitoring Plan* (AFCEE 1998a) summarizes the sampling objectives, locations, and frequency. Monitoring well samples will be collected and analyzed to monitor the EDB concentrations at the toe of the FS-28 plume. Results from the sampling of these wells will be evaluated using the Groundwater Decision Tree presented in the Technical Decision Memorandum (AFCEE 1997a). Any detection of EDB in previously "clean" sentry wells will trigger notifications and re-evaluation of the human health exposure pathways. This

¹³ The 1998 SWOU RI detected up to 0.73 µg/L of EDB in the irrigation ditches.

monitoring will be conducted to evaluate the potential risk to downgradient receptors due to the migration of EDB in groundwater. Monitoring well samples will also be collected and analyzed to monitor the performance of the groundwater extraction and treatment system and to evaluate the advance of the higher levels of EDB found in the field investigation.

Five additional rounds of air sampling for EDB, as discussed in Section 2.2.1, will be conducted at the Broad River location¹⁴. Each round will consist of air samples collected over an 8-hour period at three locations, plus QC samples. Results of the air sample analyses will be used in the SWOU RI and presented to the DPH and stakeholders in weekly technical update meetings.

5.1.1.4 Time-Critical Removal Action

The design and construction of a groundwater extraction, treatment and discharge system is divided into three phases: A time-critical removal action, a non-time-critical (interim) action, and a final remedy. The goal of the time-critical action is to conduct hot-spot removal of EDB before the higher concentration can upwell into the downgradient bogs and river system. The interim action entails engineering design, modeling and installation of additional wells to further control the upwelling of EDB into the surface water. The goal of the interim action is to capture 100 percent of the EDB plume before it upwells into the Baptiste Bogs. The final remedy will be developed as part of the SWOU RI/FS, and it will integrate all previous actions and address the appropriate remedy for the entire FS-28 plume.

The time-critical removal action groundwater ETD system will consist of bringing primary power to the site; installing a pump in well 69EW0001; installing two 20,000-pound GAC units in a temporary shelter for freeze protection; installing and burial of

¹⁴ This sampling has been completed. A total of 18 samples have now been collected from the Broad River area. Results of all air and associated water samples are presented in Appendix R2 of the Draft SWOU RI Report (AFCEE 1998b).

high density polyethylene (HDPE) for the extracted and treated water, and system controls. The system will operate continuously, extracting, treating, and discharging approximately 600 gpm to the Coonamessett River.¹⁵ The secondary objective of the first phase is to establish the influence of pumping by measuring hydraulic parameters.

Treated water will either be used for irrigation or discharged to the Coonamessett River. Re-injection of the treated water, if necessary, will be considered when evaluating a final remedy for the FS-28 plume.

The following assumptions have been used for the time-critical removal action system design:

- Above-ground treatment using granular-activated carbon to remove EDB to concentrations below the reporting limits, if technically feasible. The reporting limit for EDB is 0.01 µg/L. (Detection limits are lower than reporting limits. When data are reported at concentrations between the reporting limit yet above the detection limit, the values are "J" flagged to indicate that the results are estimated.) The resident time in the GAC will be 4 to 8 minutes.
- No treatment for metals.
- Electrical power will need to be brought to the site to operate the treatment system. Primary power will be sufficient to drive three additional pumps similar to 69EW0001.
- The treatment system will be similar to that of the CWSW and constructed on a concrete foundation that may be either temporary or of the footprint of the permanent system. Because the system will operate continuously, both the lines and treatment system will need to be winterized. For this reason, it will be necessary to construct the units on a concrete foundation and house the canisters in a building. The modular system will have a design flowrate of 600 gpm in series.
- A temporary building will be constructed, and maintained until a permanent site is acquired and a permanent system constructed. The present location has been selected to accommodate two modular treatment systems and assumes that a building may be constructed over each unit. However, this site may not be large enough for the interim action and may be potentially opposed by nearby neighbors.

¹⁵ This installation of the EW-1 system has been completed and the system is currently operating at 600 gpm.

- In the event that backwashing is needed, it will be accomplished by pumping treated groundwater into temporary tanks situated near the carbon units.
- All extracted water will be contained in double-walled pipe. Outer piping will be non-pressurized and drain to a sump for secondary containment. All treated water will be conveyed in single-walled pipe. Minimum burial depth of pipe is three feet.
- Sodium hypochlorite may be added to kill any bacteria prior to entering the GAC. No residual chlorine should remain in the system before it is discharged. Chlorine will not be added unless severe bacterial fouling occurs. Influent and effluent samples will be routinely monitored for iron-reducing bacteria.
- The extraction, treatment, and dispersal system would be manually operated but equipped with automatic shutdown in the event of a power outage, a loss of pressure, or high differential pressure. An alarm would signal operators at the SD-5 treatment plant building.

The chemical and hydraulic effects of the system will be monitored and observed during the first three months of operation. The data on water level and quality will be used to improve the conceptual and numerical models for the design of the interim action. Using this observational approach will allow remediation to begin immediately while the long-term solution is being developed.

5.1.1.5 Non-Time-Critical (Interim) Action

Data collected from removal action (69EW0001) will be utilized in the groundwater modeling to evaluate and optimize the engineering design of subsequent treatment systems. The short-term objective for the modeling will be to evaluate the environmental impacts and plume capture effectiveness of the proposed treatment system. The results of the modeling will assist in the location of the non-time-critical (interim) action extraction points. The longer term objectives of the modeling are to optimize and refine the design parameters to obtain an acceptable capture of the plume at the leading edge, and to evaluate the fate and transport of contaminated groundwater that may not be captured by the 69EW0001 treatment system.

Modeling results, design criteria, and preliminary design will be submitted for comment as a Draft Design Submittal¹⁶. Additional performance and impact monitoring will also be addressed in this submittal¹⁷. However, it should be noted that the progress and formulation of the design will be discussed in the weekly technical and monthly community action meetings.

5.1.1.6 Ecological Impact Monitoring

The ecological impact monitoring objectives and strategy for the time-critical removal action are discussed in the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998a). As the design for the interim action is developed, the data collected from initial ecological impact sampling will be reviewed and the monitoring plan will be revised to monitor any additional impacts from system expansion..

5.1.1.7 Irrigation Wells

Many of the cranberry cultivators along the Coonamessett River use surface water for spray irrigation. Because low concentrations of EDB have been detected in the Coonamessett River, irrigation wells will be drilled and developed to provide safe water for agricultural purposes (Figure 5-4)¹⁸. These wells will be drilled near the existing surface water intakes and pumps so that the new wells can be plumbed directly into the existing sprinkler systems. Table 5-1 summarizes the proposed irrigation supply wells and agricultural demand for the affected bogs, and identifies where some locations require two irrigation wells to meet the supply demand for irrigation. Wells will be drilled at six locations. A total of nine wells will be drilled; eight will be eight inches in diameter and one will be six inches in diameter. All the wells will extend approximately 50 feet below the water table. In the event that additional bogs come into operation, the hydrology of the bog will be evaluated to determine if a replacement

¹⁶ This deliverable was titled the *Final Engineering Evaluation, Cost Analysis, and Execution Plan for Coonamessett River FS-28 Bog Separation Project* (AFCEE 1998c).

¹⁷ The most recent and comprehensive plan for environmental modeling is the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998a).

water supply is required¹⁹. If the bog is in contact with the Coonamessett River or downgradient of the FS-28 plume, the irrigation water supply may be added to the sampling and analysis plan.

To determine if the groundwater is clean before installing the large-diameter wells, pilot borings will be drilled at five of the six locations using screened hollow-stem augers to collect water samples for onsite analysis. The pilot borings will be drilled to a depth of 60 feet below ground, and borewater samples will be collected for VOC and EDB analysis at 10-foot intervals. To meet the accelerated schedule for irrigation well installation, the first irrigation well drilled (69IG0004) was installed without a pilot boring. Following installation, a sample from each irrigation well will be collected and analyzed for EDB. As discussed in the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998a), one water sample for EDB analysis will be collected from three of the northernmost irrigation wells (69IG0002, 69IG0003, 69IG0004 and 96IG0012) following spray irrigation until mid-June and monthly from mid-June to October; the data from these analyses will determine if contaminated groundwater is being pulled into the well screens. As a contingency, the irrigation wells will be connected to a GAC filter system if EDB is detected in the well.

Influence of Irrigation Wells on Plume Migration. The irrigation wells installed to replace surface water sumps for agricultural purposes are not expected to impact the downgradient migration of the FS-28 plume. Field data and numerical groundwater modeling indicate that the ultimate discharge point for the EDB-contaminated groundwater is the Coonamessett River. The groundwater which contains EDB now is expected to migrate southward in the subsurface, rising in elevation as it approaches the river, and emerge ultimately to the surface along the length of the river. Modeling supports that the majority of the water containing EDB will ultimately discharge in the river between Hatchville and Sandwich roads.

¹⁸ This task (installation of nine irrigation wells) was completed in 1997.

Furthermore, the fate and transport of the EDB contamination at the leading edge of the plume is controlled primarily by the relatively large amount of groundwater entering the Coonamessett River. The effects of this discharge (on plume migration) greatly outweigh any effects of groundwater extraction from the transient irrigation wells or residential wells because the amount of water leaving the aquifer greatly exceeds any anthropogenic groundwater extraction. For example, at the point where the Coonamessett River enters the Baptiste Bogs, the river discharge is approximately 3.6 cubic feet per second (cfs) (averaged from nine biweekly measurements in 1997). Where the Coonamessett River crosses Sandwich Road, river discharge is approximately 12 cfs (averaged from 22 biweekly measurements in 1997). The contribution to the river from groundwater in the stretch between these points, is approximately 8.4 cfs (equivalent to 3780 gpm or 5.44 million gallons per day [mgd]). For perspective, the CWSW pumps about 750 gpm, or 1.08 mgd. Where the river enters Great Pond, the discharge measures approximately 18 cfs (averaged from 24 biweekly measurements) or 8100 gpm, an amount equal to over 10 times the discharge of the CWSW.

The wells were designed to provide large quantities of water for irrigation. The largest designed flow rate at an irrigation well location is 1200 gpm at the Middle Bog. Due to the nature of the agricultural demand, however, the wells are used intermittently. For normal irrigation, we understand that water is used 5 months a year, 6 days a week, 2 hours a day, with an approximate total time of 15,500 minutes a year for normal irrigation use. For frost protection, we understand that water is used 20 nights a year, 9 hours a night, with an approximate total time of 10,800 minutes a year for frost protection irrigation use. Adding normal irrigation and frost protection, the total water spraying time per year is approximately 26,300 minutes a year. Since there is a total of 525,600 minutes in a year, the fraction of time spent pumping is $(26,300/525,600)$ which equals 5 percent of the time.

¹⁹ In 1998, an additional irrigation well (69IG0012) was installed in a bog which was recently brought into operation.

Transient groundwater extraction has less of an impact on the regional hydrology than full-time extraction, especially when the pumping times are relatively short in comparison to the times when the wells are not in use. The radius of influence for these wells is relatively small because the river acts as a recharge boundary, the wells are shallow, and because the aquifer is so transmissive. When the wells are not in use, it takes very little time for the aquifer surrounding the wells to recover ambient conditions. Nevertheless, when the distance of the irrigation wells from the leading edge of the plume, the rate of the regional average linear water velocity (0.2 to 2.0 feet per day), and the limited hydraulic effects of the irrigation wells (especially in relation to the effects of the river) are compared, the likelihood of the transient groundwater extraction from these wells to affect plume transport seems small.

If any of the irrigation wells installed to replace the surface water irrigation supply were to be impacted by the EDB plume or affect plume migration, it would be 69IG0004, located at Thompson Bog. The likelihood for this to occur can be evaluated by periodic monitoring for water quality and monitoring water level changes during a single pumping event²⁰.

Augusta Bog Operation. The Augusta Bog, located north of Thomas B. Landers Road, will not be provided with an irrigation well. Instead, the bog reservoir and associated channels have been isolated from the river. Borewater sampling during drilling revealed that the leading edge of the EDB plume is near the middle of the bog at a depth of approximately 100 feet below the ground surface. Surface water and shallow groundwater sampling have shown no contamination in the bog if it is isolated from the river. As discussed in the *Draft Final FS-28 Monitoring Plan* (AFCEE 1998a), samples will be taken every two weeks at the inlet and within the reservoir (69SW0061) to monitor the effectiveness of the isolation. Samples will only be tested for EDB. In the event that EDB is detected in the surface water, a temporary GAC unit

²⁰ In 1998 a drawdown evaluation for 69IG0004 and 69IG0012 was conducted which concluded that drawdown effects during normal operation conditions were very small and localized.

will be installed to treat the surface water in the reservoir. The GAC unit will be mobilized and operational within 48 hours. Remediation and capture of this portion of the plume will be accomplished in the final remedy for the site.

5.1.2 Contribution to Remedial Performance

All of the ongoing and proposed removal actions are considered to be complementary to and consistent with any final long-term remedial action that may be implemented for the FS-28 plume. Studies conducted to date have determined that EDB will continue to discharge from the groundwater into the surface waters of the Coonamessett and Broad rivers for many years. Therefore, the time-critical response action contributes to the elimination of potential exposures.

5.1.3 Description of Alternative Technologies

Previous evaluation of remedial alternatives at similar plumes at MMR have determined that granular-activated carbon is the most proven and cost-effective method of treatment for low-levels of EDB and other volatile organic compounds. Therefore, no other alternative technologies were considered for this removal action.

5.1.4 Applicable or Relevant and Appropriate Requirements (ARARs)

Table 5-2 presents the applicable or relevant and appropriate requirements for the remediation at the leading edge of the plume.

5.1.5 Project Schedule

Figure 5-5 presents the project schedule for time-critical response actions and other actions that are being conducted and proposed for the FS-28 plume.

5.2 ESTIMATED COSTS

The estimated costs for the time-critical removal action are approximately \$750,000..

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6.0 EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

The ongoing and proposed actions are designed to mitigate the exposure and potential exposure to a release or releases of EDB into the environment from undetermined sources during the past 50 years. Because the response actions are not designed to stop or prevent a release, failure to take these actions or to delay any of them will not mitigate the environmental degradation that currently exists. However, failure to take these actions or to delay them will result in the potential exposure of the agricultural worker in the cranberry bogs to EDB.

The DEP requires the wellhead treatment as a precaution against potential contamination of the public water supply with EDB. Without the continued operation of the GAC system on the CWSW, the town of Falmouth could experience severe water shortages in the event of a major fire or during the tourist season, thus compromising public health and welfare. In the event that irrigation wells are not installed and plumbed to existing irrigation systems to provide clean water for agricultural purposes, there is a public perception that the fruit harvested by users of surface water may be compromised. In addition, without the continued monitoring of EDB concentrations in groundwater, surface water, and GAC effluent, the EDB exposure to receptors residing near and working in the affected bogs cannot be measured, and the risk from exposure cannot be managed using engineering or institutional controls.

Because field investigations have determined that relatively high (16 µg/L) concentrations of EDB are present in deep groundwater upgradient of the area where the plume is discharging to the surface environment, concentrations of EDB in the surface water may increase significantly if no actions are taken. Furthermore, failure to implement the proposed actions and continue the ongoing actions would very likely result in a significant loss of public confidence in AFCEE to mitigate perceived threats or potential threats to public health arising from releases of contamination from MMR.

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7.0 OUTSTANDING POLICY ISSUES

There are no identified policy issues that must be resolved prior to implementation of the proposed removal actions.

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8.0 ENFORCEMENT

As stated in the NCP, section 300.415(a)(2), EPA's policy concerning removal enforcement states that when potentially responsible parties (PRPs) are known, an effort shall be made, to the extent practicable, to determine whether they can and will perform the necessary removal action promptly and properly. At this time, the Department of Defense is considered the PRP for the FS-28 site. However, a definite source of the FS-28 plume at MMR has not been established, and it is likely that no definite site can be linked.

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9.0 RECOMMENDATIONS

This Action Memorandum represents the selected removal actions for the FS-28 site, developed in accordance with CERCLA as amended and consistent with the NCP. This decision is based on the administrative record for the site. The proposed response actions previously described meet the NCP criteria for a removal set forth in section 300.415(b)(2). The actions have been designed first to be protective of public health and welfare, and second to protect the environment. Those items that are protective of public health include the following:

- Continued operation, maintenance and sampling of the Coonamessett Water Supply Well. This also includes engineering and construction of a permanent system to control the fouling of the CWSW's GAC²¹.
- Collecting additional air samples to evaluate the risk to human health from the inhalation of EDB²².
- Providing bottled water and sampling the private wells of 36 residents in Hatchville until the homes are connected to the public water supply²².
- Connecting residents and one commercial business to the public water supply²².
- Continued sampling and analysis of surface water samples from the Coonamessett River to manage risk and evaluate performance of treatment until a final remedy is implemented. The plan will contain contingencies for the provision of clean water for irrigation if EDB is detected above the PQL in irrigation wells.²¹
- Designing and constructing the time-critical removal action to treat the highest concentration of EDB and to provide design data for implementation of a interim action²⁰. Removal action will be operated continuously.
- Preparing an interim action with the goal of 100-percent capture of the plume upwelling into the bog. Data compiled from the evaluation will be compiled with the preliminary design into a draft design submittal²¹.
- Providing the surface water agricultural users with an alternate water supply either by installing new irrigation wells²², treating the surface water or isolating their water supply from the river to ensure that clean water is being utilized. Sampling and analysis will be conducted prior to installation and periodically throughout the operation of the irrigation wells until a final remedy is implemented.


²¹ These tasks are ongoing.

²² These tasks have been completed.

- Implementing an ecological sampling and analysis plan to evaluate the impacts of groundwater extraction, treatment and discharge, and the fall harvest on the environment²¹.
- Conducting the Southwest Operable Unit Remedial Investigation and Feasibility Study for the entire plume to select a final remedy²¹.
- Sampling and analysis of groundwater for EDB at the leading edge and within the plume until a final remedy is implemented²¹.

This decision document represents the selected removal action for the leading edge of the FS-28 plume site, in Hatchville, MA, developed in accordance with CERCLA as amended, and not inconsistent with the NCP. This decision is based on the administrative record for the site.

Conditions at the site meet the NCP section 300.415(b)(2) criteria for a removal and I recommend approval of the proposed removal action.



 Jim Snyder
 Remedial Program Manager, AFCEE

28 Aug 99

 Date

 Paul Marchessault
 Remedial Project Manager, EPA

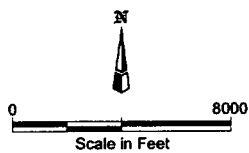
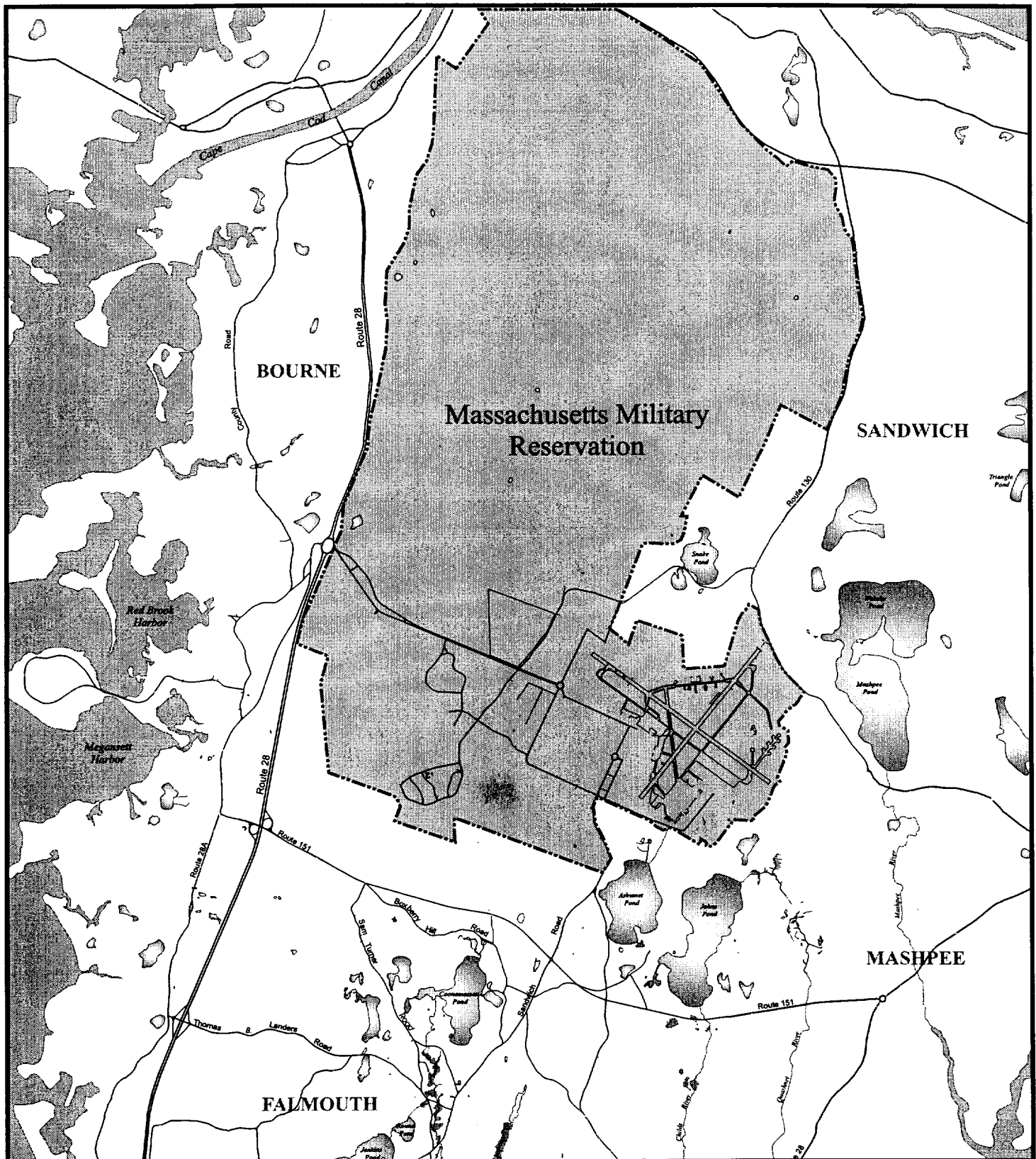
 Date

10.0 REFERENCES

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- . 1998a. *Draft Final FS-28 Monitoring Plan*. Prepared for AFCEE by Jacobs Engineering Group Inc. for AFCEE/MMR Installation Restoration Program, Otis Air National Guard Base, MA.
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FIGURES



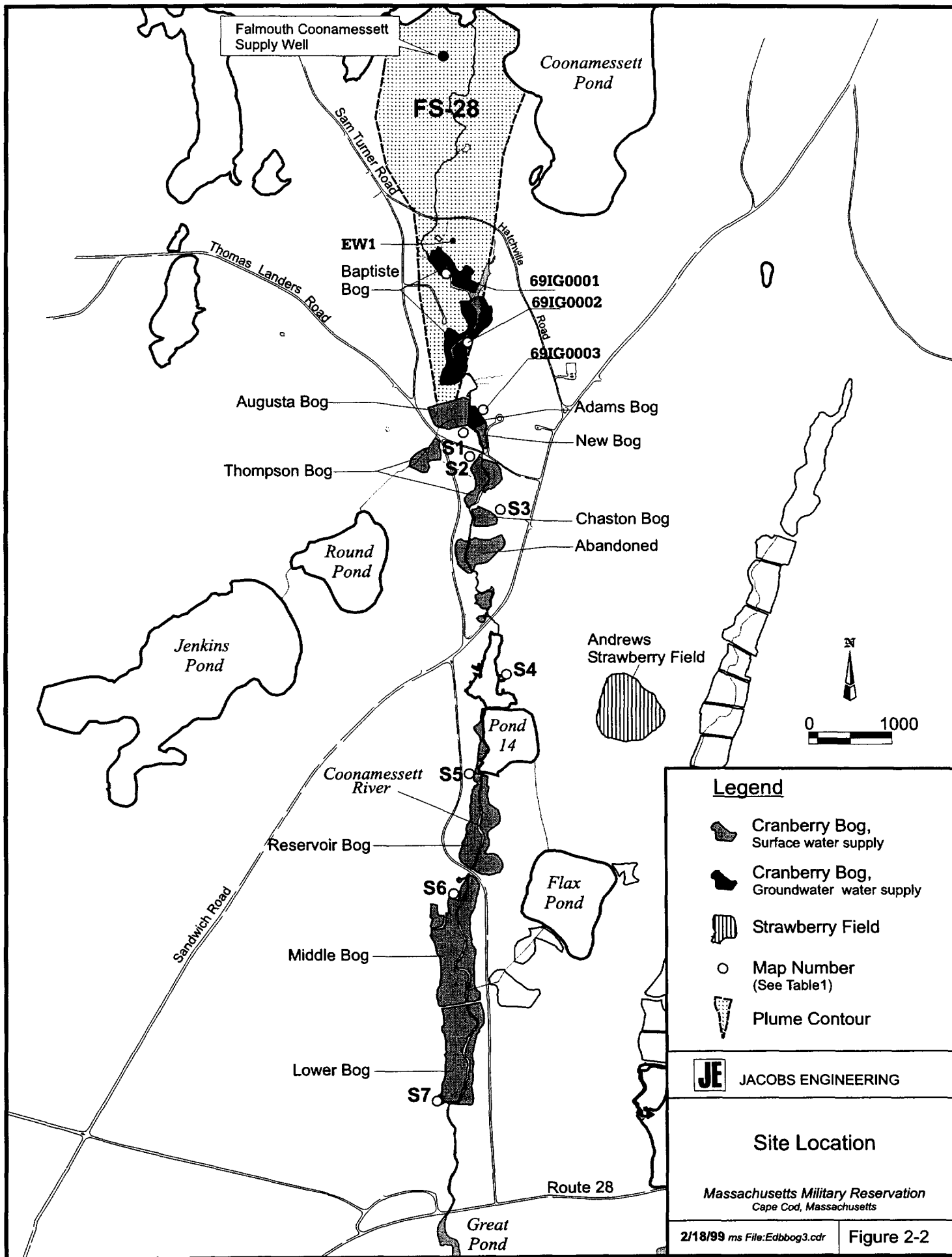
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Massachusetts Military Reservation

Massachusetts Military Reservation
Cape Cod, Massachusetts

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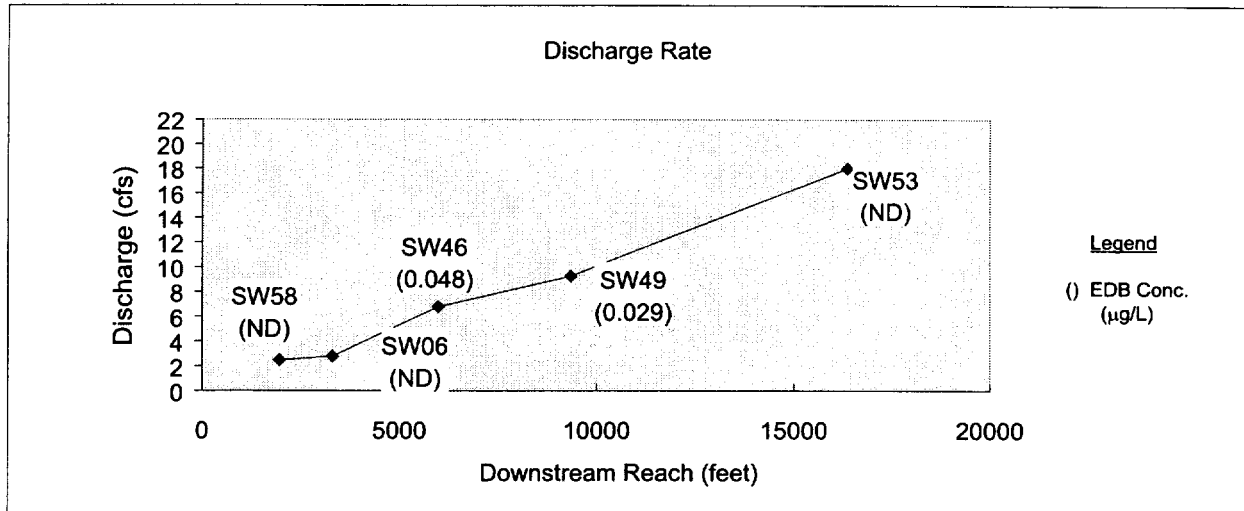
Figure 2-1



Discharge Rate and Downstream Reach on the Coonamessett River

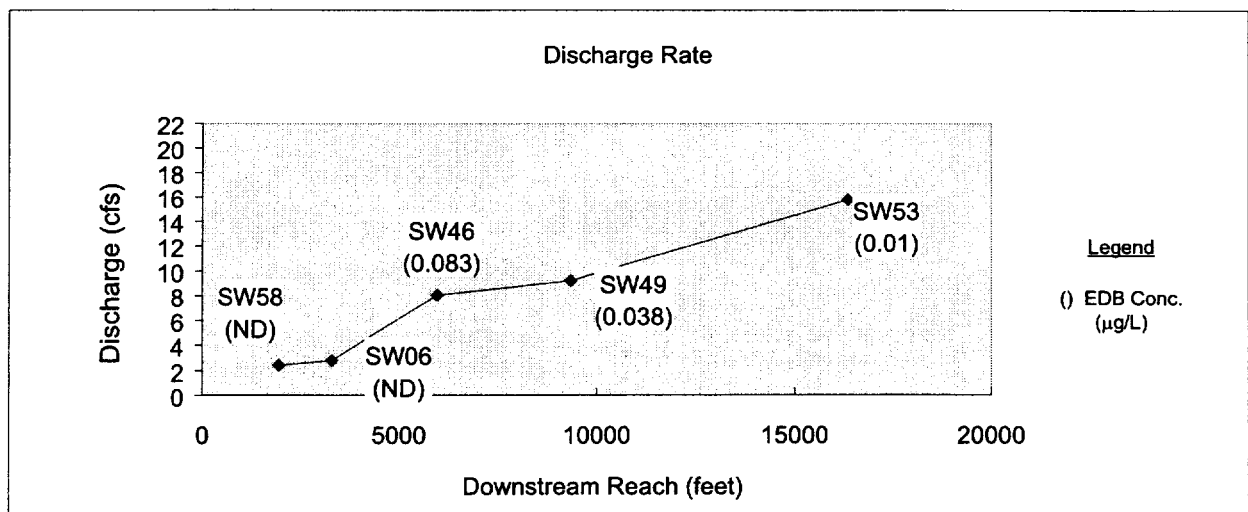
March 12/13 1997

Station Number	Downstream Reach (feet)	Discharge Rate (cfs)	EDB Conc. ($\mu\text{g/L}$)
69SW58	1969	2.48	ND
69SW06	3302	2.79	ND
69SW46	5969	6.79	0.048
69SW49	9340	9.26	0.029
69SW53	16361	18.01	ND



March 27/28 1997

Station Number	Downstream Reach (feet)	Discharge Rate (cfs)	EDB Conc. ($\mu\text{g/L}$)
69SW58	1969	2.42	ND
69SW06	3302	2.81	ND
69SW46	5969	8.05	0.083
69SW49	9340	9.2	0.038
69SW53	16361	15.77	0.01



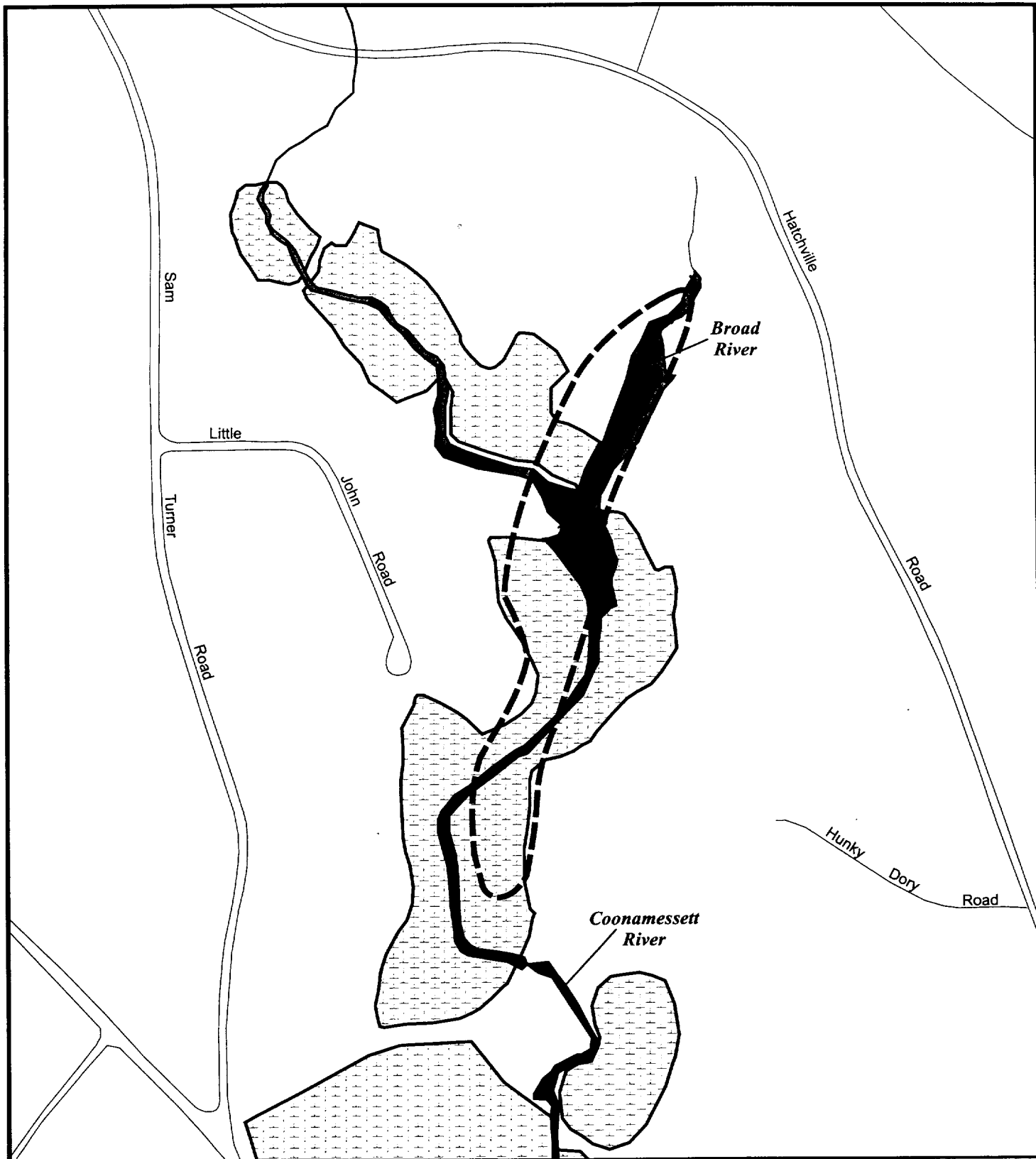
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Discharge Rate and Downstream Reach on the Coonamessett River

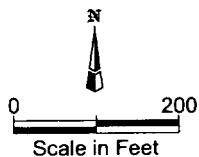
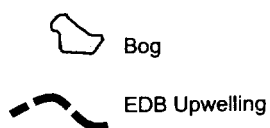
Massachusetts Military Reservation
Cape Cod, Massachusetts

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Figure 2-4



Legend



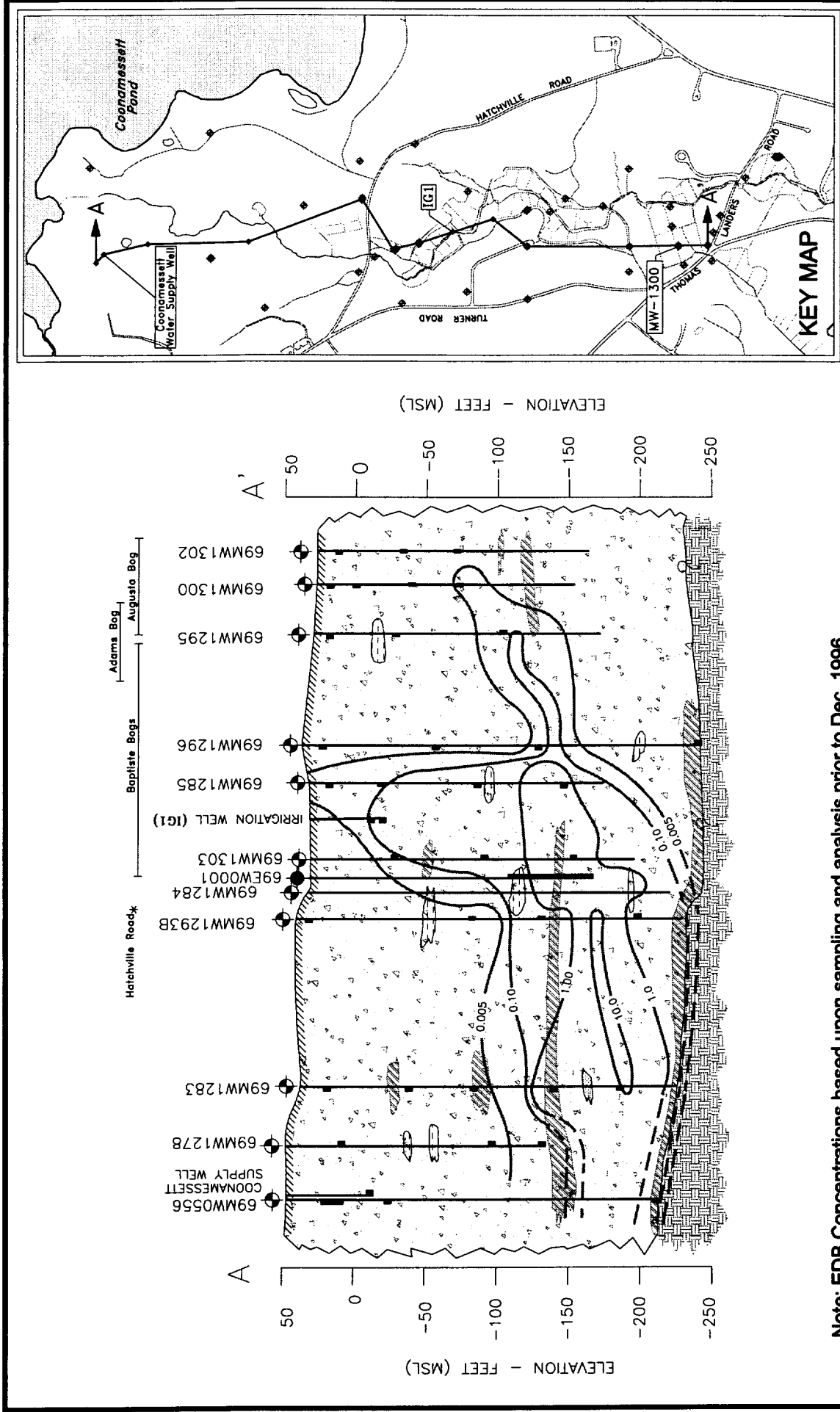
JACOBS ENGINEERING

Interpreted Area of EDB Discharge to Surface

Massachusetts Military Reservation
Cape Cod, Massachusetts

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Figure 2-5



JACOBS ENGINEERING

Geologic Cross-Section A-A'

Massachusetts Military Reservation
Cape Cod, Massachusetts

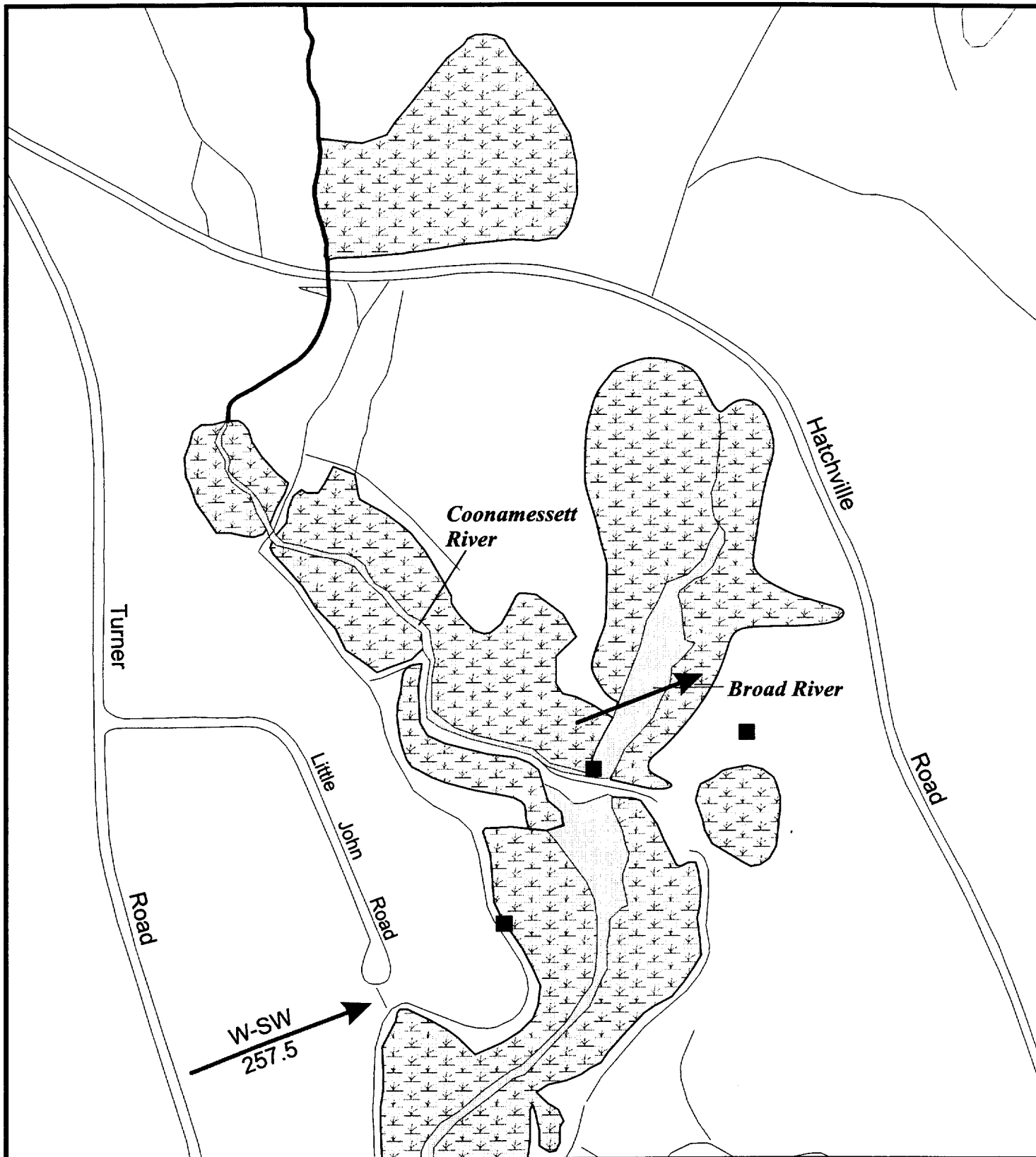
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Figure 2-6

Legend

	Monitoring Well	ND	Not Detected		Sand
0.02	Monitoring Well Sample	ND	Screened		Silt
— 0.02	EDB Concentration Isopleth	ND	Auger Samples		Gravel
			Well Screen		Bedrock

Note: Concentrations in µg/L



Legend



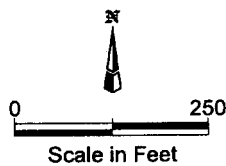
Air Sampling Locations



Bogs



Prevailing Wind Direction
for May, June, July and August
1946-1986, also measured on
site 29 May 1997.



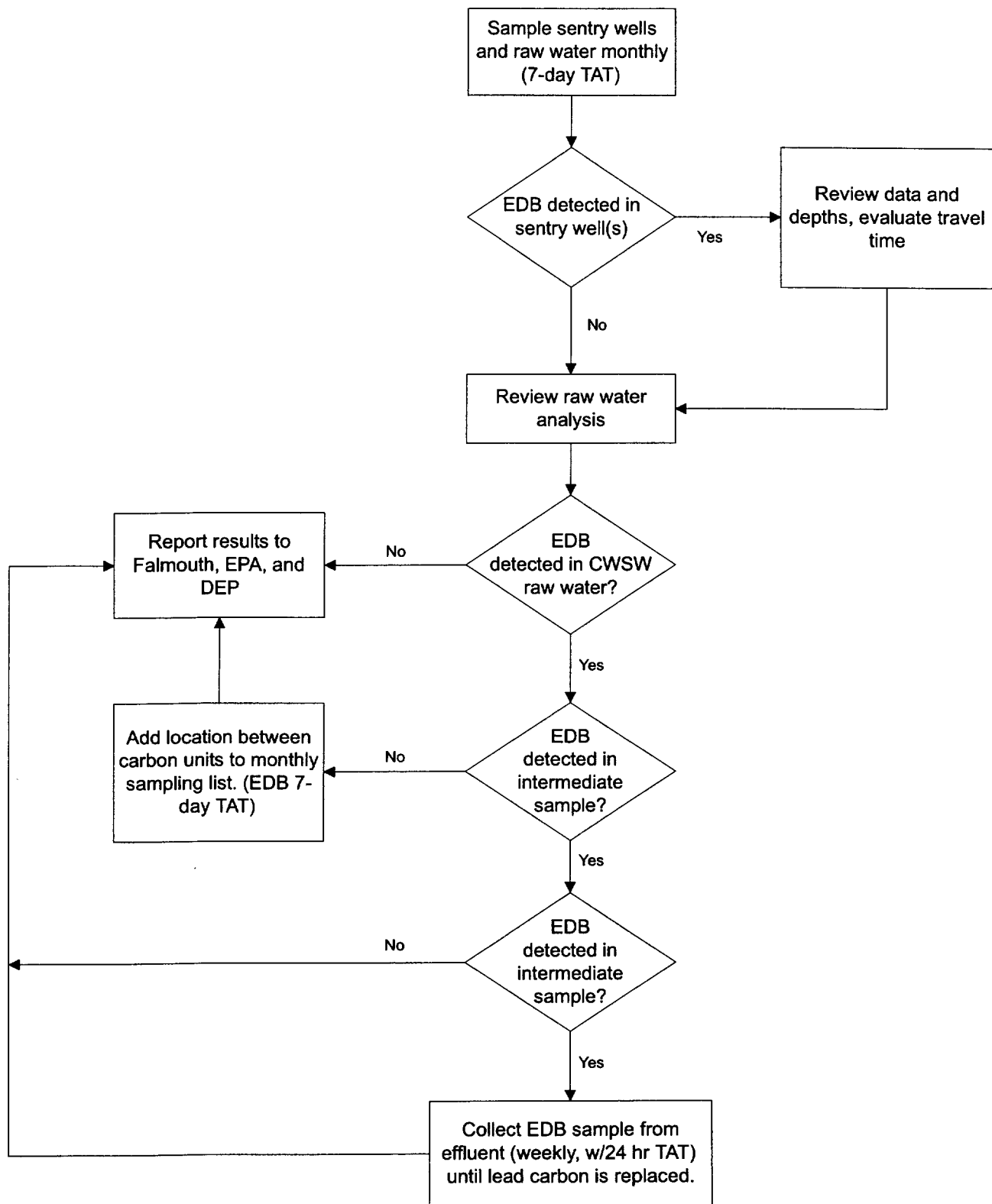
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Air Sampling Locations

Massachusetts Military Reservation
Cape Cod, Massachusetts

2/18/99 ms File:Broadr1.cdr

Figure 2-7



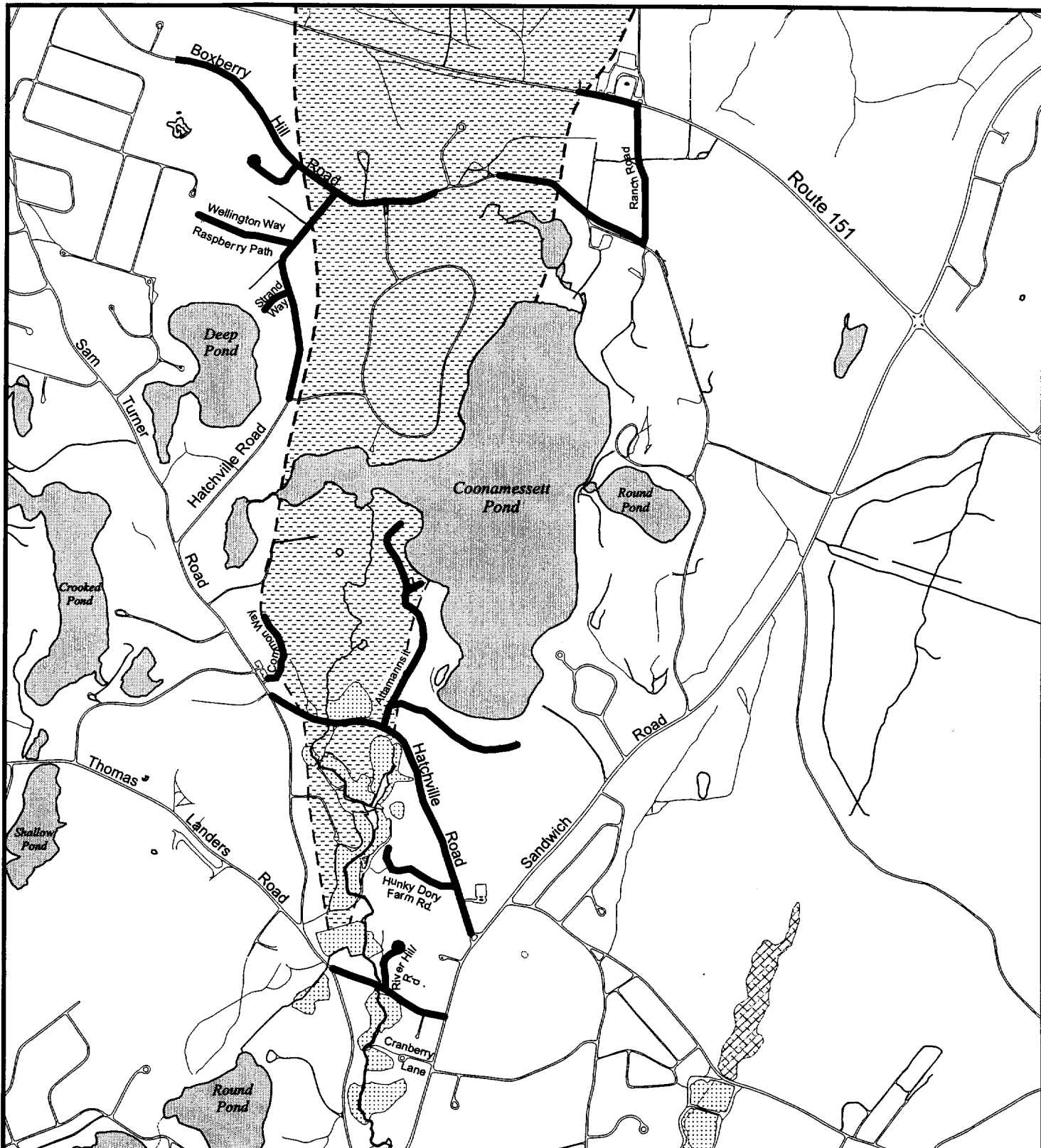
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CWSW Decision Tree




Massachusetts Military Reservation
Cape Cod, Massachusetts

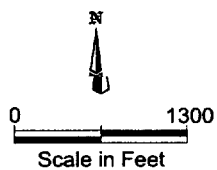
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Figure 5-1



Legend

-  Water Supply
-  Plume Contour
-  Bog



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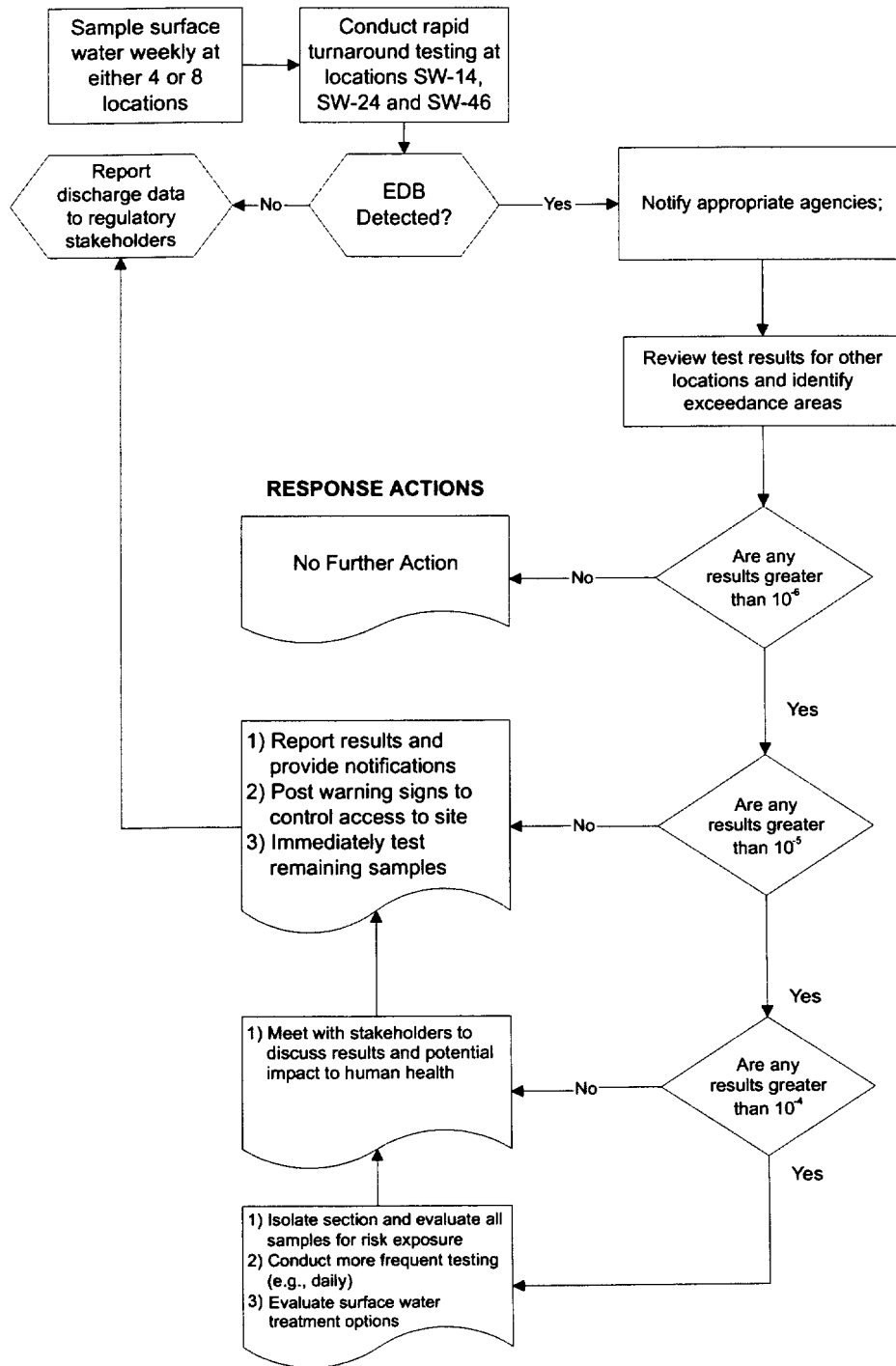
Location of Public Water Supply Extensions

Massachusetts Military Reservation
Cape Cod, Massachusetts

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Figure 5-2

SURFACE WATER DECISION TREE



* Risk equivalent concentrations are based on an integrated receptor scenario.

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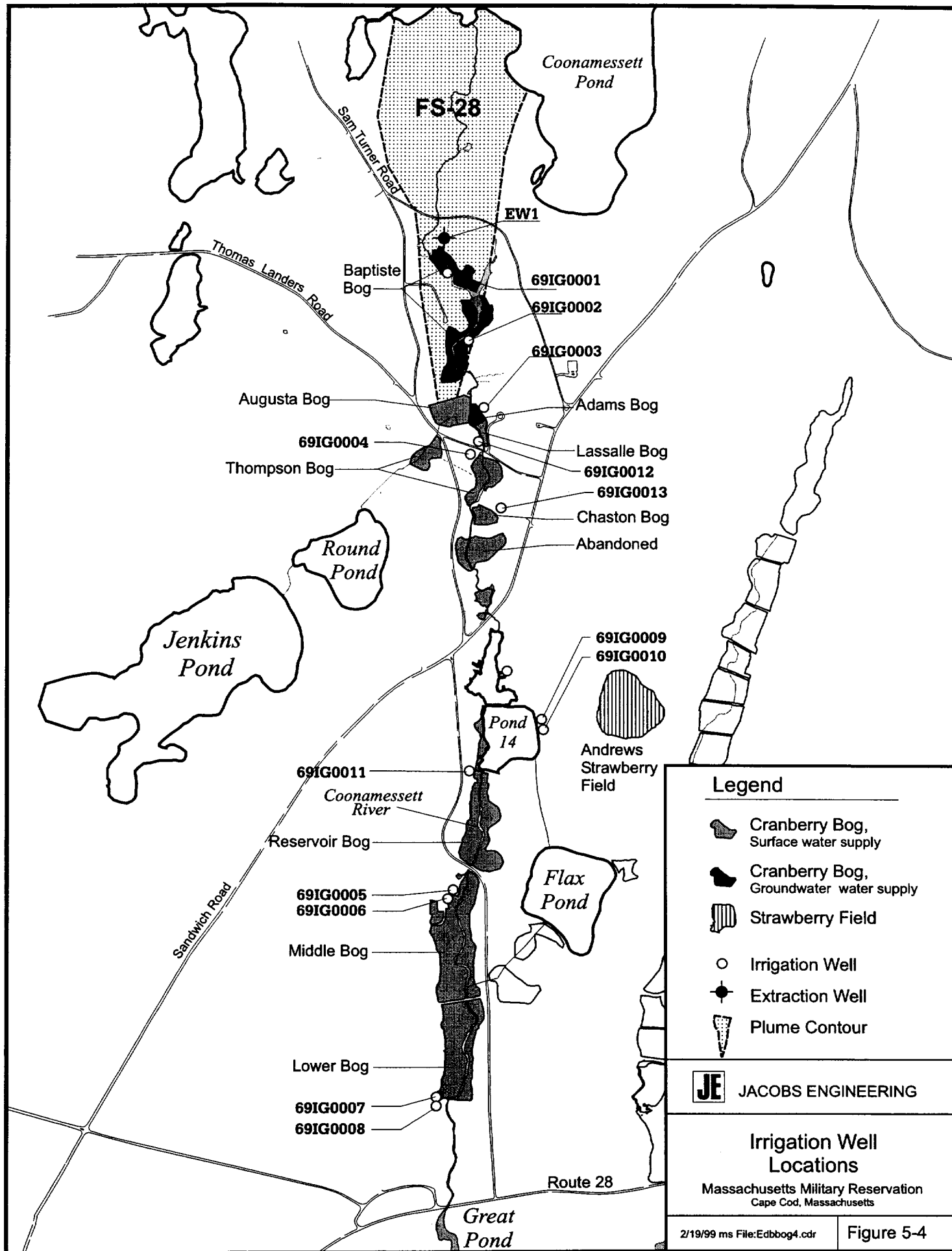
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Surface Water Decision Tree

Massachusetts Military Reservation
Cape Cod, Massachusetts

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Figure 5-3



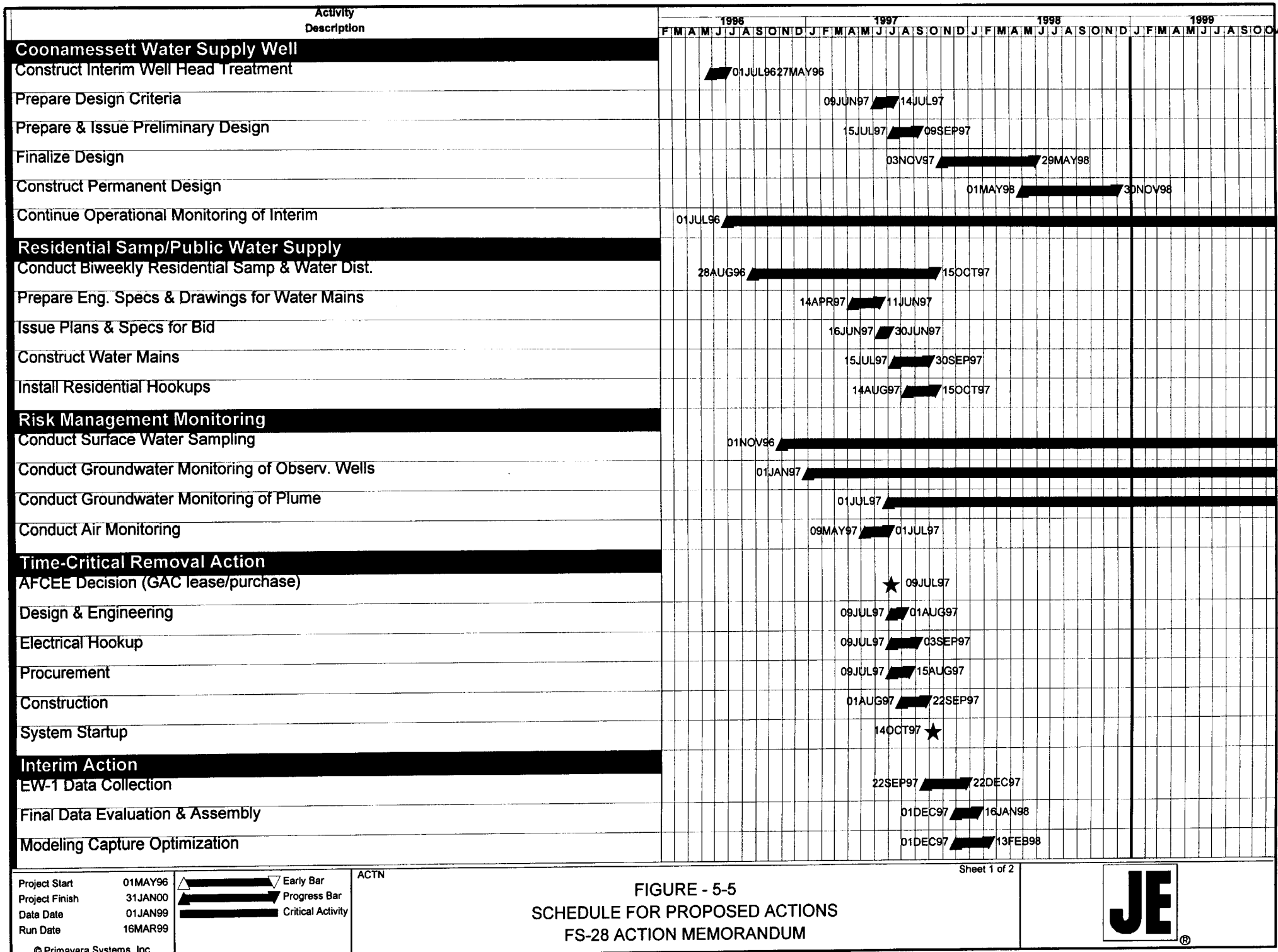
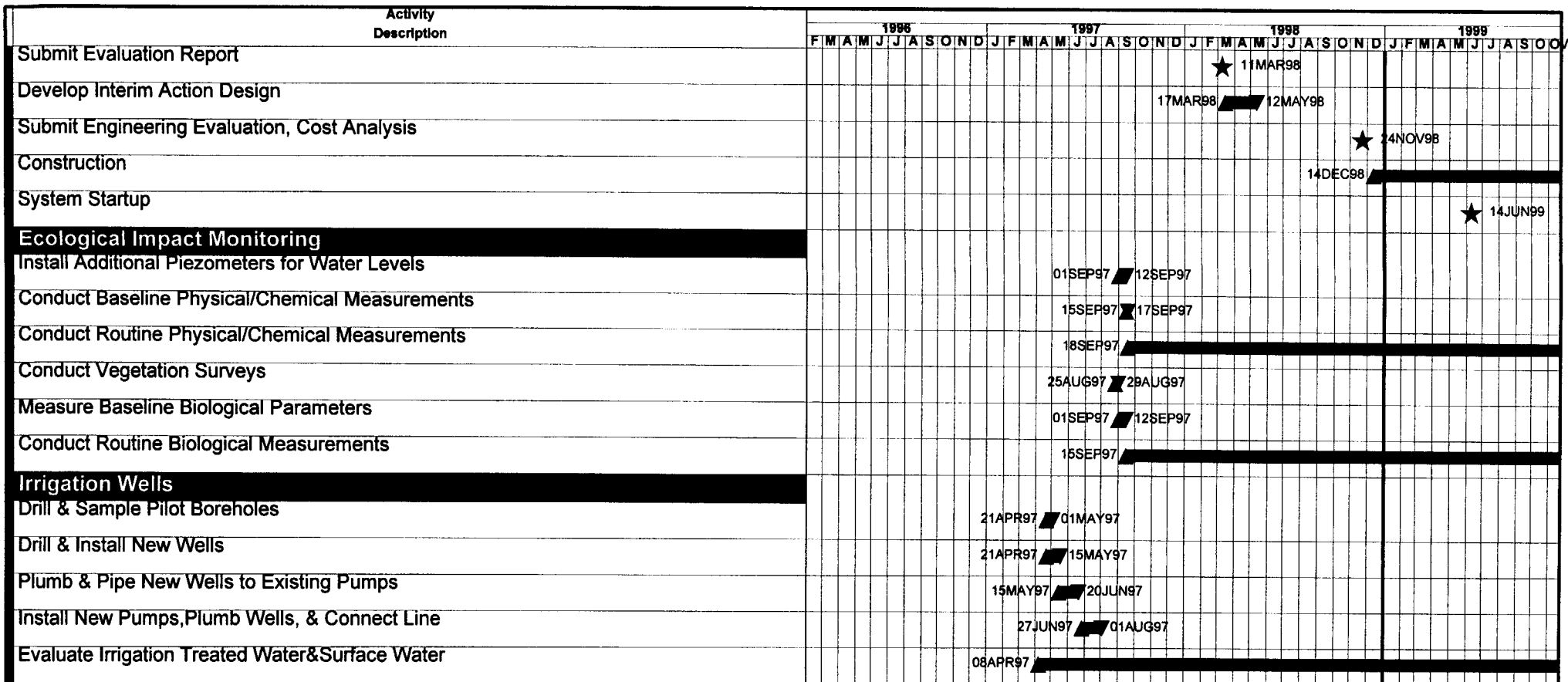





FIGURE - 5-5
SCHEDULE FOR PROPOSED ACTIONS
FS-28 ACTION MEMORANDUM



Project Start	01MAY96		Early Bar
Project Finish	31JAN00		Progress Bar
Data Date	01JAN99		Critical Activity
Run Date	16MAR99		

ACTN

Sheet 2 of 2

FIGURE - 5-5
SCHEDULE FOR PROPOSED ACTIONS
FS-28 ACTION MEMORANDUM



TABLES

**Table 2-1
Irrigation Water Usage Summary for Affected Bogs and Farm**

Map Location ID*	Parcel Description	Owner / Manager	Crop	Water Source	Acreage	Number of Sprinkler Heads	Required Flow Rate (gpm)	Design Flow Rate (gpm)
IG1	Baptiste Bog	Handy	Cranberry	GW	3.64	66	297	300
IG2	Baptiste Bog	Handy	Cranberry	GW	6.60	119	536	500
S1	Augusta Bog	Augusta	Cranberry	SW	7.50	135	608	600
IG3	Adams Bog	Adams	Cranberry	GW	1.00	18	81	100
	Lassalle Bog	Handy	Cranberry	SW	1.50	27	122	140
S2	Thompson Bog	Handy	Cranberry	SW	1.91	35	158	160
	Thompson Bog	Handy	Cranberry	SW	3.13	57	257	260
S3	Chaston Bog	Chaston	Cranberry	SW	1.50	18	81	100
S4	Andrews	Andrews	Strawberries	SW	10.24	184	828	800
S5	Reservoir Bog	Handy	Cranberry	SW	7.84	142	639	650
S6	Middle Bog	Handy	Cranberry	SW	13.68	247	1112	1200
S7	Lower Bog	Handy	Cranberry	SW	10.60	191	860	900

GW = groundwater SW = surface water gpm = gallons per minute

Number of Sprinkler Heads = (18 sprinkler heads x acreage)

Required Flowrate = (number of sprinkler heads x 4.5 gallons)

* See Figure 2.

Table 4-1
Exposure Parameters (RME) for Calculating
Risk Equivalent Concentrations in Surface Water

Parameter	Adult-Wading	Adult-Fisher	Child-Wading	Cranberry Worker
BW (kg)	70	70	15	70
AT (day)	25550	25550	25550	25550
CF ₁ (mg/μg)	0.001	0.001	0.001	0.001
ED (yr)	24	30	6	25
EF (day/yr)	104	350	104	12
SA (cm ²)	6600	NA	3400	6600
PC (cm/hr)	0.003	0.003	0.003	0.003
CF ₂ (L/m ³)	0.001	0.001	0.001	0.001
ET (hr/d)	1	1	1	8
SF _o (mg/kg-day) ⁻¹	85	85	85	85
IR _w (L/day)	0.05	0.05	0.05	0.05
SF _i (mg/kg-day) ⁻¹	0.77	0.77	0.77	0.77
IR _i (m ³ /hr)	1.6	NA	1.2	3.3
VF (m ³ /kg)	0.2	0.2	0.2	0.2

where:

AT	averaging time	IR _w	surface water ingestion rate
BW	body weight	PC	dermal permeability factor
CF ₁	conversion factor 1 (mg to μg)	REC	risk equivalent concentration
CF ₂	conversion factor 2 (cm ³ to L)	RME	reasonable maximum exposure
ED	exposure duration (to surface water)	SA	skin surface area
EF	exposure frequency (to surface water)	SF _i	inhalation slope factor
ET	exposure time (to surface water)	SF _o	oral slope factor
IR _i	inhalation rate	VF	volatilization factor

Table 4-2
Risk Equivalent Concentrations in Surface Water
for EDB (µg/L)

Risk Level	Adult-Wading	Adult-Fisher	Child-Wading	Cranberry Worker	Integrated Receptor
1 x 10 ⁻⁷	0.0080	0.0008	0.0090	0.0250	0.00065
1 x 10 ⁻⁶	0.080	0.0080	0.090	0.250	0.0065
1 x 10 ⁻⁵	0.80	0.080	0.90	2.5	0.065
1 x 10 ⁻⁴	8.0	0.80	9.0	25.0	0.65
1 x 10 ⁻³	80.0	8.0	90.0	250.0	6.5

Notes:

Ingestion, dermal absorption, and inhalation exposure routes included.

RME exposure scenario is used.

BAF = 10 L/kg is used.

<u>Receptor</u>	<u>Percent of Contribution to Risk For Integrated Receptor</u>
Adult wader	8.3 %
Child wader	7.1 %
Worker	2.6%
Fisher	82.0%

**Table 5-1
Irrigation Well Drilling Summary**

Irrigation Well Location ID	Pilot Boring Borehole ID	Parcel Description	Owner/ Manager	Crop	Required Flow Rate (gpm)	Design Flow Rate (gpm)	Drilling Proposed
69IG0004	NA	Thompson Bog	Handy	Cranberry	158 + 257	160 + 260	One 8" diameter well (20' screen)
69IG0013	69BW000F	Chaston Bog	Chaston	Cranberry	81	100	One 6" diameter well (20' screen)
69IG0009 69IG0010	69BW000C 69BW000G	Andrews	Andrews	Strawberries	828	800	Two 8" diameter wells (20' screen)
69IG0011	69BW000D	Reservoir Bog	Handy	Cranberry	639	650	One 8" diameter well (30' screen)
69IG0005 69IG0006	69BW000A	Middle Bog	Handy	Cranberry	1112	1200	Two 8" diameter wells (20' screen)
69IG0007 69IG0008	69BW000B	Lower Bog	Handy	Cranberry	860	900	Two 8" diameter wells (20' screen)
69IG0012	NA	LaSalle Bog	Handy	Cranberry	140	140	One 6" diameter (10' screen)
NA	NA	Abandoned Bog	This bog will not be cultivated in 1997 season and does not require immediate action to provide irrigation water.				
NA	69BW000E	Augusta Bog	This bog is irrigated by a spring-fed recirculating water system with a tail water recovery reservoir. To prevent surface water contamination, dikes have been constructed to prevent river water from entering the bog, which is partially underlain by the groundwater plume. No irrigation well is planned at this time.				

Required Flow Rate = (number of sprinkler heads x 4.5 gallons (Table 1)) NA = not applicable gpm = gallons per minute Total wells = 9 (one 6" well and eight 8" wells)

69IG0001, 69IG0002, and 96IG0003 were installed previously.
69IG0012 was installed in May, 1998.

Table 5-2
ARARs, Criteria, and Guidance for FS-28 Removal Actions

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
<u>CHEMICAL-SPECIFIC REQUIREMENTS</u> <u>Federal</u> Federal AWQC and Water Quality Standards (33 USC 1251 <u>et seq.</u> ; 40 CFR 131.36 and 125.61)	Relevant and Appropriate	Federal AWQC are health-based criteria developed for carcinogenic and noncarcinogenic compounds and water quality parameters. AWQC are set at levels protective of human health for two routes of exposure: (1) drinking water and consuming fish, and (2) only consuming fish. Remedial actions must consider the uses of the water and the circumstances of the release or threatened release; this determines whether AWQC are relevant and appropriate.	Sampling and treatment of surface water in the Broad and Coonamessett rivers will meet these standards. These standards will be met for discharge through compliance with NPDES standards.
SDWA - MCLs (40 CFR 141.60 - 141.63)	Relevant and Appropriate	MCLs have been promulgated for organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water.	<p>The CWSW will be treated to meet these standards. In addition, residential wells will be sampled to ensure that standards are not exceeded. Finally, the ETR system will be designed to treat extracted groundwater to these standards.</p> <p>For residential well sampling and well-head treatment, MCLs will be <i>applicable</i>. For the ETR system, MCLs are <i>relevant and appropriate</i>.</p>
EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are considered the levels unlikely to cause significant adverse health effects associated with threshold mechanism of action in human exposure for a lifetime.	EPA RfDs were used to calculate risk-based cleanup levels for noncarcinogens.
EPA Carcinogen Assessment Group, Cancer Slope Factors (CSFs) <u>State</u> Massachusetts Drinking Water Regulations (310 CMR 22.00)	To Be Considered Relevant and Appropriate	CSFs represent the most up-to-date information on cancer risk from EPA's Carcinogen Assessment Group. Massachusetts Drinking Water Standards are generally equivalent to federal MCLs. When state levels are more stringent than federal levels, the state levels must be attained. The state MCL for EDB is 0.02, which is more stringent than the federal MCL of 0.05.	EPA CSFs were used to compute the cancer risk-based cleanup levels for EDB. The CWSW will be treated to meet these standards. In addition, residential wells will be sampled to ensure that standards are not exceeded. Finally, the ETR system will be designed to treat extracted groundwater to these standards.

Table 5-2
ARARs, Criteria, and Guidance for FS-28 Removal Actions
(continued)

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Massachusetts Groundwater Quality Standards (314 CMR 6.00)	Applicable	These standards limit the concentration of certain materials allowed in classified Massachusetts waters. The groundwater beneath MMR has been classified as Class I water or fresh groundwater found in the saturated zone of unconsolidated deposits and is designated as a source of potable water.	These standards will be attained because the clean-up levels or potential discharge limits were set using these as guidelines. Treated water may be reinjected back into the aquifer.
Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Relevant and Appropriate	These regulations limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of the receiving waters are protected and maintained or attained. Discharges may be limited or prohibited to protect existing uses and not interfere with the attainment of designated uses in downstream and adjacent segments.	These standards will be used to set cleaning levels for surface water treatment in the Broad and Coonamessett rivers.
<u>LOCATION-SPECIFIC REQUIREMENTS</u> <u>WETLANDS</u> <u>Federal</u> Protection of Wetlands - Executive Order 11990 (40 CFR 6, Appendix A)	Applicable	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Wetlands Executive Order. Under this order, federal agencies are required to minimize the degradation, loss, or destruction of wetlands, and to preserve the natural and beneficial values of wetlands. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available. If no alternative is available, effects from implementing the chosen alternative must be mitigated.	Removal actions (i.e., extraction of water for irrigation) within a cranberry bog or other wetland will be done in a manner to minimize the impact. Altered areas will be repaired or restored.

Table 5-2
ARARs, Criteria, and Guidance for FS-28 Removal Actions
(continued)

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
<u>State</u> Massachusetts Wetlands Regulations (310 CMR 10.00)	Applicable	<p>These regulations protect inland and coastal wetlands, as well as a 100-foot buffer zone, from activities that may alter the resource area. Some wetlands receive additional protection as wildlife habitat. Status of wildlife habitat is determined by the presence of particular plant communities or hydrologic characteristics.</p> <p>The regulations specifically prohibit the loss of over 5,000 square feet of bordering vegetated wetlands. The loss may be permitted with replication of the lost area within two growing seasons.</p>	If FS-28 removal actions alter more than 5,000 square feet of protected area, the affected area will be restored within two growing seasons. Piping and construction activities will be performed to meet the substantive requirements of the regulations.
<u>OTHER NATURAL RESOURCES</u> <u>Federal</u> Endangered Species Act (16 USC 1531 et seq.) (50 CFR 17.11-17.12)	Applicable	<p>This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modifying their habitat.</p>	No federally classified endangered or threatened species were identified at MMR. If endangered or threatened species in the site area are identified during the design phase, activities will be designed so as not to adversely affect listed species.
<u>State</u> Massachusetts Endangered Wildlife and Wild Plants (321 CMR 8.00)	Applicable	<p>The Commonwealth of Massachusetts has authority to research, list, and protect any species deemed threatened. These species are listed as either endangered, threatened, or species of special concern in the regulations. The Massachusetts lists may differ from the federal lists of endangered species.</p> <p>Actions must be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program.</p>	Three state-listed species (grasshopper sparrow, upland sandpiper, northern harrier) are known to inhabit the grassland areas of MMR. Any species in the site area listed by the state as endangered, threatened or of special concern will be identified during the design phase. Activities will be designed so as to not adversely affect listed species.

Table 5-2
ARARs, Criteria, and Guidance for FS-28 Removal Actions
(continued)

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
<u>ACTION-SPECIFIC REQUIREMENTS</u> <u>Federal</u> RCRA Identification and Listing of Hazardous Wastes; Toxicity Characteristics (40 CFR Part 261.24)	Relevant and Appropriate	These requirements identify the maximum concentrations of contaminants for which the waste would be a RCRA-characteristic hazardous waste for toxicity. The analytical test given in Appendix II is referred to as the TCLP.	Spent carbon sent offsite for disposal (not including regeneration) will be analyzed for TCLP. If TCLP results exceed the standards in 261.24, the material will be disposed of offsite in a RCRA-permitted TSD facility.
RCRA - Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262)	Relevant and Appropriate	This requirement sets standards for generators of hazardous waste that address (1) accumulating waste, (2) preparing hazardous waste for shipment, and (3) preparing the uniform hazardous waste manifest. These requirements are integrated with U.S. Department of Transportation regulations.	If RCRA-characteristic hazardous wastes are generated from the FS-28 treatment system or well installation and shipped offsite, the material must be shipped in proper containers that are accurately marked and labeled, and the transporter must display proper placards. All waste shipments must be accompanied by an appropriate manifest.
DOT Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171, 172)	Applicable	These regulations outline procedures for the packaging, labeling, manifesting, and transporting of hazardous materials.	Hazardous and contaminated materials will be packaged, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations. Spent carbon that will be shipped offsite for regeneration would be characterized for the list of hazardous substances given in 49 CFR 172.101 Appendix A.
Rivers and Harbors Act of 1899 (33 USC 403; 33 CFR Parts 320-323)	Relevant and Appropriate	Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the Secretary of the Army, acting through the Army Corps of Engineers, for the construction of any structure in or over any "navigable water of the U.S." It also requires such authorization for the excavation from or deposition of material in such waters, or any obstruction or alteration in such waters.	Permits are not required for CERCLA onsite actions. The substantive requirements will be met for installation of any surface water treatment in the rivers, and for piping installed in the cranberry bog or the Coonamessett River.
National Pollutant Discharge Elimination System (NPDES) (40 CFR 122-125 and 131)	Applicable	Establishes discharge limitations, monitoring requirements and best management practices for any direct discharge from a point source into surface water.	Discharges of treated water from surface water treatment or the ETR system into the Broad River, Coonamessett River or cranberry bogs will meet substantive requirements.

Table 5-2
ARARs, Criteria, and Guidance for FS-28 Removal Actions
(continued)

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Fish and Wildlife Coordination Act (16 USC 661 <i>et seq.</i>)	Relevant and Appropriate	This act requires that any federal agency proposing to modify a body of water must consult with the U.S. Fish and Wildlife Service, National Marine Fisheries Services, and other related state agencies to develop measures to prevent, mitigate or compensate for project-related losses to fish and wildlife. Such action should be viewed in the context of obtaining maximum overall project benefits such as cleaning up the site. The requirements to comply with this Act are contained in EPA's NPDES permit regulations (40 CFR 122.49).	Actions will be taken to develop measures to prevent, mitigate or compensate for project-related impacts to fish and wildlife. Relevant agencies will be contacted to help analyze the impact on fish and wildlife from installing surface water treatment in the Broad River, and discharging treated water to the Coonamessett River or cranberry bog.
<u>State</u> Massachusetts Hazardous Waste Management Regulations Location Standards for Facilities (310 CMR 30.700 - 30.707)	Relevant and Appropriate	Under these standards, a new facility may not be located in an area subject to flooding; within the watershed of a Class A or Class SA segment of the surface water body unless it is determined that there is no feasible alternative; on land overlying an actual, planned, or potential public or private drinking water source; or in the flow path of groundwater supplying water to an existing well. In addition, there shall be a minimum of 300 feet from the active portion of the facility to the facility property line.	Any treatment facilities will be located and operated to fulfill these regulations unless there is no feasible alternative. A waiver may be requested for the distance from the treatment facility to the property line.
Massachusetts Groundwater Discharge Permits (314 CMR 5.00)	Relevant and Appropriate	These regulations provide permit information, including conditions and variances.	Discharge of treated water to the ground or groundwater would comply with the substantive requirements of these regulations.
Massachusetts Surface Water Discharge Permits (314 CMR 3.00)	Relevant and Appropriate	These regulations include permit application procedures, permit reviews, variances, and permit conditions.	Discharge of treated water to a surface water body (i.e., Coonamessett River, the Broad River or cranberry bogs) would comply with the substantive requirements of these regulations.

Table 5-2
ARARs, Criteria, and Guidance for FS-28 Removal Actions
(continued)

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	These regulations set emission limits necessary to attain ambient air quality standards.	Removal actions (e.g., well drilling and the installation of piping) will be conducted to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); noise (310 CMR 7.10); and volatile organic compounds (310 CMR 7.18). If standards are exceeded, emissions will be managed through engineering controls. In addition, air monitoring will be conducted on the Broad River in the vicinity of where EDB has been upwelling to ensure that contaminant levels released into the ambient air do not exceed the standards

Notes:

ARAR = Applicable or Relevant and Appropriate Requirement
AWQC = Ambient Water Quality Criteria
CERCLA = Comprehensive Environmental Response Compensation and Liability Act
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
CSFs = cancer slope factors
CWSW = Coonamessett Water Supply Wells
EDB = ethylene dibromide
EPA = United States Environmental Protection Agency
ETR = extraction, treatment, reinjection
MCLs = Maximum Contaminant Levels
MGL = Massachusetts General Law
MMR = Massachusetts Military Reservation
NPDES = National Pollutant Discharge Elimination System
RCRA = Resource Conservation and Recovery Act
RfDs = Reference Doses
SDWA = Safe Drinking Water Act
TCLP = Toxicity Characteristic Leaching Procedure
TSD = treatment, storage, disposal
USC = United States Code

APPENDIX A

**Responses to Comments on the Draft FS-28 Action Memo
Issued May 2, 1997, Responses to the Draft Final FS-28
Action Memo Issued June 6, 1997, and Memorandum of
Resolution for Comments on the Revised Draft Final FS-28
Action Memo issued July 8, 1997**

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from MDPH

Comment #1: The recent detection of ethylene dibromide (EDB) in the ambient air above Broad River Reservoir highlights the need for a continuous air monitoring network, as we recommended in our letter to you on March 6, 1997. The air around all of the affected bogs and reservoirs, not just the Broad River Reservoir, should be continuously monitored as part of this sampling program. Consideration should be given to wind direction in interpreting sampling results. It would be especially important to collect samples during any times when spray irrigation with Coonamessett River water is occurring. Because these events are difficult to predict, a continuous air monitoring network is the only way to guarantee that samples will be collected during these events.

Response: Disagree. It is not technically practical nor appropriate to monitor air concentrations in the bogs surrounding the Coonamessett River because aqueous EDB has not been found at the high concentrations which would be required for airborne EDB to be quantifiable. Given the uncertainty with the assumptions for modeling performed by DPH, it is our opinion that the modeled air concentrations are much higher than would be seen in the field. Your memorandum states that "if the EDB concentration in the river were to increase to 9 µg/L, the maximum predicted air concentrations of EDB would be approximately equal to the CREG".

Since the best-available technology for analyzing EDB concentrations in air cannot detect the CREG value of 5 ng/m³, it is our opinion that our resources would be better spent monitoring the concentration of EDB in the water and developing a remedial system to prevent the high concentrations (maximum of 16 µg/L) of EDB from reaching the surface environment. Furthermore, alternative water is being provided to the bog users so monitoring of EDB during spraying would yield no useful information. Because the sensitivity of the method has been increased to achieve the low levels we are concerned that the low level exceed the sampling devices capabilities. For this reason in the past week we have collected three samples to monitor the downwind and crosswind concentrations. These results will be evaluated to determine if other sampling should be conducted.

Comment #2: The Action Memorandum does not specify a final remedy for the EDB plume or the schedule on which a remedy will be implemented. The effectiveness of the final remedy is crucial for preventing long-term opportunities for exposure to EDB in the Coonamessett River system. In contrast, the environmental monitoring and provisions to supply clean water to cranberry growers along the river are short-term, interim measures to be implemented until a final remedy can be installed and demonstrated to be effective. Therefore, this Action Memorandum should include a substantive discussion of the final remedy for the EDB plume.

Response: The actions presented in the Action Memorandum include time-critical response actions which will reduce risk to human health and the environment. These actions should not be confused with the final remedy for the EDB plume which will be a product of the Feasibility Study which will follow the completion of the Remedial

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from MDPH

Investigation. However, the actions taken at the leading edge are likely consistent with the final remedy. The feasibility study will not only address the leading edge at Thomas B. Landers but the entire plume as delineated in the RI. We agree that the effectiveness of the final remedy is crucial for preventing long-term opportunities for exposure to EDB in the Coonamessett River system.

Comment #3: The Water Management Plan to provide clean water to cranberry growers for flooding their crops is an integral part of the overall remedial plan for the EDB plume. Consequently, this plan should be developed and included in the Action Memorandum so that interested parties can comment on its merits prior to its implementation.

Response: In order to expedite the production of the Water Management Plan and the meetings which will be required to create the plan, AFCEE proposes to limit the participating parties to those directly involved with the control of flow in the Coonamessett River (AFCEE staff and contractors, agricultural users of surface water, Falmouth Conservation Commission, and the Falmouth Shellfish Constable). The plan, as it comes together, could be discussed with interested parties (EPA, DPH, DEP) so they can comment on its merits prior to document release and plan implementation. Outlines can be presented in the weekly technical meetings with the regulatory agencies.

Comment #4: The risk equivalent concentrations used in the Action Memorandum were derived without consideration of the potential for exposures to EDB via consumption of fish from the Coonamessett River. This Action Memorandum should contain a detailed justification for this omission. Furthermore, given that bench-scale tests on the partitioning of EDB into fish tissue have not been completed, it seems premature to eliminate this exposure pathway from risk calculations. While we understand that it is difficult to include past opportunities for exposures in current, quantitative risk assessments, MDPH continues to be concerned about past opportunities for exposure for long-term residents which may present additional health risks.

Response: Table 2 of Project Note #AFC-J23-35K78408-P5_038 ("Surface Water Risk Equivalent Concentrations of Ethylene Dibromide Version #2") presents the RECs which include the fish ingestion pathway. When fish ingestion is combined with all other pathways, it contributes more than 99% of the calculated REC. It is AFCEE's opinion that it is not appropriate to include the fish ingestion pathway. Ongoing studies will determine whether or not the fish ingestion pathway is viable. Two of the justifications for omitting the fish ingestion pathway include the limited contact the herring have with EDB-contaminated water and the uncertainty associated with the bioaccumulation factor of 14 which is presented in the MMR Risk Assessment Handbook. Current literature supports the position that organic compounds with log octanol-water partitioning coefficients ($\log K_{ow}$) values less than 4 (EDB $\log K_{ow} = 1.8$) will not partition (much less accumulate) into fish tissue. It is our opinion that the fish ingestion does not represent a reasonable pathway and does not impact the time-critical actions being undertaken by AFCEE.

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from EPA

Comment #1: Unclear how the actions proposed in the Action Memo will “prevent the cranberry crop from being impacted (page 3-1, Section 3.2). Although “clean” source of irrigation water to be provided to farmers and surface water treatment in the Broad River will be part of “Water Management Plan” to be issued in mid-June, contaminated groundwater is still flowing through bog system and cranberry crop is in direct contact with the Coonamessett River. The actions outlined in the memo do not propose to remediate surface water [or ground water].

Response: The objective of the proposed extraction and treatment system is to prevent EDB-contaminated water from upwelling into the river. This will hopefully provide a long-term solution for the problem of potential EDB impacts on the cranberry crop. The Water Management Plan will hopefully provide a short-term solution until the effects of the groundwater extraction and treatment system are realized. The time-critical action included in the Draft Final Action Memorandum on this issue will be to prepare the Water Management Plan. Any plans to treat surface water or groundwater for the purposes of preventing impact to the cranberry crop will be presented in the Water Management Plan. Additional text has been added to the Water Management section of the Action Memorandum to clarify the treatment of surface water. Also, as a point of clarification the vines and fruit are not exposed to the Coonamessett River. Typically, the bog operators try to keep the water level at least 16 inches below the plants. The only time the plants would be impacted is during flooding or spray irrigation.

Comment #2: Two weeks ago, Tony Andrews (strawberry farmer) irrigated for fertilizing using surface water (no buds on plants); he uses Pond 14 (reservoir) for surface water irrigation which is fed by river; influent and effluent has had detectable concentrations of EDB. Any plans to add strawberries to fruit testing program?

Response: The cranberry fruit testing will be conducted by the DPH, and it seems appropriate that they should sample strawberries, as well. AFCEE does not have any plans to sample or test the fruit.

Comment #3: Nine new irrigation wells are to be installed along the river at flow rates ranging from 100 gpm to 1200 gpm. (Existing sources of irrigation water include groundwater and surface water, but new scenario includes only groundwater as source.) Other than modeling using a steady-state model, AFCEE has not produced any data which verifies that this increased demand on the aquifer will not have an impact on the movement of the plume. At a minimum, the steady-state model should be run assuming maximum pumping rate of the new wells to assume worst case pumping scenario.

Response: AFCEE has discussed with Jacobs, the USGS, and the DEP the technical feasibility of modeling the impact of the irrigation wells on plume migration. Modeling is not practical for the following reasons:

- The wells are pumped intermittently, and the current models are steady-state simulations of the flow field. (Simulating the groundwater wells at full rate for a “worst

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from EPA

case" scenario doesn't seem appropriate, given that in reality the wells would be used approximately 5% of the time.)

- The wells are located adjacent to the river from which the water would be removed if the wells weren't used.
- The wells are relatively shallow (about 50 feet deep), and much of the water surrounding the river is moving into the river anyway.
- The water being extracted from the wells is in most cases being returned to the river system very near the point of extraction. We can assume, though, that some of the water used for irrigation is lost to evaporation and transpiration.
- A two-dimensional model would not effectively simulate the effects of the river as a recharge boundary or "sink" for water mass.
- The effect of most of the wells on the plume migration would be negligible simply because many of the wells are located so far away from the current plume extent. Even if the groundwater extraction would affect plume pathways, the effect wouldn't occur for many years- the amount of time required for groundwater at the leading edge to move (via horizontal advective flow) to the point of groundwater extraction.
- Field data collected during the pumping of an irrigation well indicates that the radius of influence during pumping is relatively small.

Our conclusion is that if nothing is done to contain the plume, the fraction of the plume which does not discharge to the surface north of Thomas B. Landers Road will continue to migrate in the subsurface underneath the Coonamessett River, and ultimately discharge to the River in pieces, however never reaching Great Pond. The estimated time required for travel from Hatchville Road to the furthest discharge location is in the neighborhood of 100 years. Therefore, it is likely that if nothing is done to contain the plume and the irrigation wells are pumped intermittently for decades, the wells may affect gradients such that local to the river, the EDB discharge to the river is slightly accelerated and may possibly enter some irrigation wells.

Comment #4: Unclear how ongoing and proposed activities reduce the likelihood that higher concentrations of EDB in the surface water won't increase since highest concentrations of EDB detected are in groundwater upgradient of the area where the plume is discharging.

Response: The proposed groundwater extraction, treatment, and discharge system, once online, will capture the EDB plume which is migrating upward toward the surface. However, the effect of the system on surface water concentrations will not be seen immediately. Water outside the zone of capture will continue to upwell to the surface, and it is possible that in the short term, surface water concentrations of EDB may increase. The plume will detach downgradient of the system and eventually flush through to it's ultimate destination, the river and associated irrigation channels. In the long term, however, the plume migrating toward the bogs will be intercepted by the

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from EPA

remedial system and water in the river will be comprised of clean untreated water and clean treated water.

Comment #5: Schedule proposed in Figure 9 suggests that surface water sampling will cease in late October after the bogs are flooded for the winter season. AFCEE feels that at this point they'll have collected a year's worth of monitoring data, including monitoring under flooded conditions. Monitoring should be continued to assess the effectiveness of the ETR system and monitor surface water concentrations after flooding.

Response: The schedule has been revised to indicate which tasks are funded and which are not funded at this time. Currently, sampling past October is not funded.

Performance monitoring will be planned and performed to evaluate the effectiveness of the ETR system. Sampling frequency of the irrigation wells or monitoring wells will take into consideration the location of the wells with respect to the plume, the time required for reduction in aquifer concentrations of EDB to occur, and the time required for effects to be seen at the various locations. Surface water sampling will likely continue past October (however the number of locations and the frequency of sampling will change) to continue to evaluate the risk to human health and the environment. Surface water sampling may also be included as part of performance monitoring.

Comment #6: The "Schedule for Actions" presented in Figure 9 states that existing irrigation wells will be sampled on a monthly basis. This is unacceptable. Although IG-2 and IG-3 have repeatedly tested non-detect for EDB, these wells are located on the edge of the plume and will likely be impacted by the slightest movement of the plume.

Response: The Revised Action Memorandum proposes to sample 69IG0002, 69IG0003, and 69IG0004 following each irrigation event until mid-June. From mid-June through October the 3 wells will be sampled monthly. AFCEE feels that the sampling frequency is appropriate, given the groundwater flow rates and the geographic location of these wells with respect to the plume. Furthermore, beginning in mid-June surface water samples will be collected from the Augusta bog reservoir and the inlet. Additional text has been written in the revised plan to reflect a contingency for the Augusta Bog.

Comment #7: There are no contingencies in place or under development for dealing with EDB detections at newly installed irrigation wells. The decision tree on page 11-8 deals specifically with EDB detections in surface water and only proposes institutional controls for exceedances of established "risk equivalent concentrations." In addition, the actions outlined in the decision tree seem to contradict what is being proposed in the action memo, e.g. highest concentration of EDB detected in surface water to date is 0.37 ppb which is in acceptable risk range (goes well beyond reporting results, providing notification, conducting more testing and analysis, and posting warning signs).

Response: Noted. The surface water decision tree has been revised. In the Final Action Memorandum, a decision rule will be included in the section which discusses irrigation

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from EPA

well installation and sampling. Contingency of placing the well or surface water body on a granular activated carbon filter system has been added to the Action Memorandum.

Comment #8: While the Action Memorandum purports that "all of the ongoing and proposed removal actions are considered to be complementary to and consistent with any final long-term remedial action that may be implemented for the FS-28 plume, "AFCEE has not provided EPA with any modeling data or pump test data to support this statement and only proposes to conduct plume monitoring from October 13, 1997 to October 31, 1997 while the bogs are being flooded. This is unacceptable. Groundwater sampling and analysis at the leading edge and within the plume should continue throughout the installation and operation of the new irrigation wells to confirm the location of the plume (impact on long term remediation strategy and potential impact on other, currently unimpacted private wells).

Response: The intention of the referenced statement was to indicate that, although a final remedial solution has not been selected, we believe that the initial extraction well which has been installed and probably the next one or two wells which are proposed will continue to be used as part of a final remedial solution. The Revised Action Memorandum includes a description of the proposed modeling which will be conducted to evaluate the improvement to plume containment by adding one or two more extraction wells to the existing 69EW0001. As mentioned in the response to EPA Comment #3, AFCEE feels that the best approach to evaluating the effects of groundwater extraction in such a complex hydraulic setting is to measure the effects (on water levels and EDB concentrations) and use the data to improve the conceptual and numerical models. Using the observational approach also allows AFCEE to immediately begin remediation while the design for the long-term solution is being developed.

Comment #9: DPDO plume appears to be portion of CS-4 plume that is not being captured by CS-4 extraction fence. AFCEE proposes to address this portion of the CS-4, the source and upgradient portion (northeast of western arm of Coonamesett Pond) of the FS-28 plume, and other yet-to-be-addressed plumes, in a Southwest Regional Operable Unit RI/FS (work to begin in October when FY98 funding available). An enforceable schedule for these activities should be developed and implemented immediately.

Response: The response actions presented in this Action Memorandum only address the EDB plume below and downgradient of the Coonamesett Water Supply Well. In regard to the solvent plume located 2000 feet west of the CS-4 extraction well fence, the connection to CS-4 has not been established.

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from DEP

Comment #1: Subsequent to the issuance of the Memorandum, AFCEE stated that they would install a temporary extraction, treatment, re-injection (ETR) system by mid-June 1997, and a permanent ETR system by October 1998 at the latest to protect the public health and the environment. The Department applauds this decision and requests the Revised Memorandum include a plan and schedule for these activities.

Response: Comment noted. The Revised Memorandum includes a schedule for funded activities and a schedule for unfunded activities.

Comment #2: The Department is concerned that the Memorandum either recommends actions only through October 30, 1997, or reduced actions due to funding limitations. For example, AFCEE proposes:

- Continuing the Coonamessett Water Supply Well (CWSW) wellhead treatment only until October 30, 1997;
- Sampling and analysis of the Coonamessett River (surface water sampling stations) only until October 30, 1997;
- Installation of one extraction well near Hatchville Road upgradient of irrigation well #1, but no additional modeling or installation of another extraction well until funding is available. It is also unclear if this references extraction well #1 (EW-1), previously installed;
- Granular Activated Carbon (GAC) available for one irrigation well (unclear if references GAC previously installed at irrigation well #1); and
- Provide clean irrigation water for the Augusta bog by isolating the irrigation water reservoir from the Coonamessett River.

Response: The description of proposed actions has been rewritten for clarity. Regarding the schedule, see response to EPA Comment #5.

Comment #3: The Department is concerned that these activities as proposed are not adequate to protect public health and the environment. The Department recommends continued wellhead treatment at the CWSW; continued sampling and analysis of the Coonamessett River as part of the ETR monitoring; a contingency plan for additional GAC if needed for any of the irrigation wells; the installation of one or two extraction wells and modeling as necessary for effective implementation of the temporary ETR; and a clean irrigation water source for the Augusta bog that is a more reliable provision than isolation from the river.

Response: AFCEE intends to continue wellhead treatment at the CWSW. Regarding continued sampling, see response to EPA Comment #5. The Revised Action Memorandum includes a description of the proposed modeling which will be conducted to evaluate the improvement to plume containment by adding one or two more extraction wells to the existing 69EW0001.

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from DEP

Comment #4: AFCEE proposes the following additional activities which were previously approved in the FS-28 RI/FS Workplan, only if funds are available: a focused feasibility study for the entire plume; selection of final remedy; and groundwater sampling and analysis at the leading edge of plume. The Department recommends completion of these activities.

Response: Noted.

Comment #5: Given that the Water Management Plan (WMP) is critical to reduce human health and ecological risk, the Department recommends that the WMP be included with the Revised Memorandum. The Department recommends that the MWP include an evaluation of the potential impacts of the irrigation wells on the plume and the private well use in the area. The Department repeats its request that the Revised Memorandum include analytical and/or numerical modeling, drawdown calculations, pump test data, chemical and hydraulic monitoring, etc. on the use of the irrigation wells. This information is necessary in order for AFCEE to comply with the substantive requirements of the Water Management Act. In addition, the Department request more frequent monitoring of the irrigation wells to document groundwater quality and effectiveness of the ETR system. Finally, the Department recommends that AFCEE meet the Cape Cod Cranberry Growers Association (CCCGA) deadline of September 15, 1997 for providing clean surface water for frost protection, and harvesting.

Response: In order to expedite the revision of the Action Memorandum, the Water Management Plan will not be included in the Draft Final version. The WMP would be an appropriate appendix to the Final Action Memorandum, if scheduled appropriately. Alternatively, the WMP may be issued as a stand-alone document.

Regarding the modeling of effects of irrigation wells, see response to EPA Comment #3.

According to representatives from the DEP Executive Office of Environmental Affairs, modeling is not necessarily required for irrigation wells. Furthermore, the only irrigation wells which have been installed as part of the Plume Response Program which meet the criteria for permits are the bogs which are managed by Handy Cranberry Trust. However, because the irrigation wells are being installed as a time-critical removal action, the wells are not subject to the regulation (Section 300.400(e) of the NCP: "(1) No federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA sections 104, 106, 120, 121, or 122. The term "on-site" means the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action.") In addition, the DEP and the Town of Falmouth are in agreement that because Falmouth owns the property, Falmouth owns the wells and would be responsible for meeting permitting requirements at a future time when AFCEE relinquishes control of them.

Performance monitoring will be planned and performed to evaluate the effectiveness of the ETR system. Sampling frequency of the irrigation wells or monitoring wells will take

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from DEP

into consideration the location of the wells with respect to the plume, the time required for reduction in aquifer concentrations of EDB to occur, and the time required for effects to be seen at the various locations. The Revised Action Memorandum proposes to complete installation of a 1-well groundwater extraction, treatment, and discharge system and collect field data and perform numerical modeling to optimize the design of an expanded system which would include up to 3 extraction wells. As the design for the system progresses, the plans for performance monitoring will be finalized.

It is AFCEE's intention to provide clean water for the autumn harvest.

Comment #6: The Department recommends that recent air monitoring results be included in the Revised Memorandum and that the section on Potential Risk be revised. Given that the data from the May 14, 1997 sampling event indicate a detect of EDB in air, and given that the Department of Public Health (DPH) Technical Memorandum dated March 5, 1997, indicates a potential downwind inhalation threat, the Department also repeats its request for continuous air monitoring. Finally, the Department recommends an air sample be collected at a residence to address potential residential exposure.

Response: AFCEE is in the process of interpreting the data quality level and usability of the sample collected May 14, 1997. It should be noted that although the result may indicate the detection of EDB in air, the validity of this result is questionable and, when the CLP data package for this sample is reviewed, may be rejected.

It is AFCEE's opinion that it is not technically practical nor appropriate to monitor air concentrations in the bogs surrounding the Coonamessett River because EDB has not been found at the high concentrations which would be required for airborne EDB to be quantifiable. Given the uncertainty with the assumptions for modeling performed by DPH, it is our opinion that the modeled air concentrations are much higher than would be seen in the field. Your memorandum states that "if the EDB concentration in the river were to increase to 9 µg/L, the maximum predicted air concentrations of EDB would be approximately equal to the CREG". Since the best-available technology for analyzing EDB concentrations in air cannot detect the CREG value of 5 ng/m³, it is our opinion that our resources would be better spent monitoring the concentration of EDB in the water and developing a remedial system to prevent the high concentrations (maximum of 16 µg/L) of EDB from reaching the surface environment.

Comment #7: There is conflicting information in the literature regarding the potential for EDB to bioaccumulate/bioconcentrate. In one case, EDB's high volatility indicates a low probability to bioaccumulate/bioconcentrate. However, EDB's high octanol water partitioning coefficient indicates that it may bioaccumulate/bioconcentrate. DPH is currently conducting shellfish sampling in Great Pond, and this study will provide data that may be used to resolve the inconsistency in the literature. The Department recommends that this data be used to determine if the fish ingestion pathway should be included in the risk evaluation. Until the results are available, the fish ingestion pathway should be included in the risk evaluation. If the data indicate that the fish ingestion

Responses to Comments on Draft FS-28 Action Memorandum
Issued May, 1997
Comments from DEP

pathway is not realistic, then it could be removed from the risk evaluation. Table 3 should be revised to reflect this change.

Response: See response to DPH Comment #4. No change to Table 3 is proposed.

Comment #8: The Surface Water Decision Tree does not adequately describe response actions or institutional controls. Also, the Department does not advocate the use of flooding of the bogs as in institutional control to prevent further downstream migration. Although the flooding may reduce the migration of EDB contaminated surface water, it may enhance the migration of EDB contaminated groundwater.

Response: The Surface Water Decision Tree has been revised. In deciding how to respond to the occurrence of high concentrations of EDB in surface water, all the potential impacts should be evaluated. While flooding may increase downgradient subsurface migration of EDB, a field experiment conducted at Broad River indicates that increasing the retention time of surface water will decrease EDB concentrations. Since the exposure pathways at the site are more critical for surface water than for groundwater, AFCEE recommends that this option be considered so that risk to human health is included in the decision.

Comment #9: Table 5 ARARS:

- Chemical Specific Requirements: Under "Action Taken" for consistency with the Plume Response Decision Criteria, the treated water should be treated to background (non-detect) if technically feasible, and not just to a level that prevents Ambient Water Quality Criteria (AWQC) exceedances;
- Massachusetts Wetland Regulations: Under "Actions Taken" the piping and construction activities associated with new irrigation wells (as replacement for surface water usage) should be included here; and
- Rivers and Harbors Act of 1899: Under "Action Taken" the substantive requirements for piping will be met. However, according to the Office of Watershed Management (OWM), the substantive requirements that should be met are essentially the hydrogeologic requirements for example: 1. Pump tests looking at potential impacts to wetlands, rare species habitat, surface water bodies, and other critical areas within 1,000 feet and potential impacts to groundwater users within 0.5 mile; 2. If potential impacts are identified, mitigation or longterm monitoring may be necessary; and 3. Limits on water withdrawal need to be set, most likely at the volume limit for which the use is presently registered.

Response: The text is not incorrect as written. Remediation goals (of concentrations less than AWQCs) will be discussed in the report text. The treatment system will be designed and operated to achieve no detections of EDB.

- Sentence will be added "Piping and construction activities will be performed to meet the substantive requirements of the regulations."
- AFCEE will review the requirements of the Act.

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from DEP

GENERAL COMMENTS:

1. Although the AFCEE has stated that they intend to install an extraction, treatment, reinjection (ETR) system in a phased-approach, it is unclear how this will be accomplished, and exactly what aspects of the ETR system are currently funded. AFCEE had previously committed to mid-June, and then mid-July for the installation of a temporary ETR system; however, it appears that the only funded activity associated with the ETR is the installation of electrical power, piping, and a pump for extraction well #1. There are no operational/monitoring tasks funded. Also, it is unclear how and when the Phase II and Final Phase will start; it is unclear from the Action Plan and Schedule how Phase II activities which are currently unfunded will be carried out. The Department requests a clear plan and schedule for implementing the ETR system.

Response: On June 30, 1997 a meeting was held between AFCEE, Jacobs, and the Regulatory RPMs to clear up the confusion of the ETR. The Action Memorandum has been revised to reflect the agreements reached at the meeting which include a Time-Critical Removal Action, Interim Action and the Final Remedy. This terminology replaces the former Phase I and Phase II. As discussed in the meeting AFCEE is committed to installing the removal action using EW-1 as soon as possible. The revised Action Memo presents the schedule for engineering design and construction of the Removal and Interim Actions. The final remedy for the FS-28 will be completed as part of the SWOU RI/FS.

Also discussed during the meeting was the elimination of funding requirements. The Action Memorandum has been revised to reflect the planned activities independent of funding.

2. It is unacceptable that the following tasks necessary to protect public health and the environment are not funded:

- Wellhead treatment at the Coonamessett Water Supply Well (CWSW);
- Phase I ETR operation and monitoring;
- Phase II ETR system, and Final ETR system;
- Operation/monitoring for Phase I, Phase II and Final Phase;
- Ecological monitoring; and
- Surface water and sediment sampling from Coonamessett Pond (previously part of the approved and funded FS-28 RI/FS Work Plan).

Additionally, the Memorandum does not clearly distinguish between tasks that have already been completed and those that are proposed. This is particularly confusing when trying to follow what is planned and what is funded.

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from DEP

Response: Noted. The Action Memorandum has been revised to reflect all of the responses that are required to be protective of human health. Operation and Maintenance of the CWSW will continue by AFCEE until the system is turned over to the Town of Falmouth. Sampling of the raw water will continue on a monthly basis and in accordance with the decision tree recently presented to the regulatory agencies. The revised Draft Final Action Memorandum incorporates this decision tree. The Phase I system has been changed to a Time-Critical Removal Action and the Phase II is an Interim Action to contain the upwelling. The Removal Action will be brought on line, winterized and operated continuously to provide hot spot treatment of the higher concentrations of EDB. The unit will consist of a GAC unit contained within a building. Approval of the building and concrete pad from the Falmouth Conservation Commission is necessary before construction can occur. The removal action will also provide hydraulic characteristics and operational features of the system such that the interim action can be designed and implemented. AFCEE is committed to design and construction of the Interim Action during FY 98. The Final remedy of the site will be determined in the SWOU RI/FS, while the interim action is being installed. A schedule for completion has been revised in the revised Draft Final Action Memorandum. Ecological impact monitoring and sampling of the Coonamessett River will be conducted. The revised Draft Action Memorandum includes an Appendix of the sampling objectives and frequency. The ecological sampling will be conducted in accordance with the Basewide Ecological Sampling Plan.

Action Memorandum has been revised to reflect those actions that have been completed, ongoing, and proposed.

3. It is not clear how AFCEE plans to separate activities associated with the toe of the FS-28 Plume, from the activities associated with the body of the FS-28 plume, and the proposed Southwest Operable Unit (SWOU). The Department recommends that the activities at the toe of the FS-28 plume be treated separate from the SWOU and the body of the FS-28 plume, and be completed without delay.

Response: The Time Critical Removal Action and the Interim Action deal specifically with the toe or leading edge of the plume. The goal of the Interim Action is to capture 100% of the EDB plume upwelling into the Baptiste Bog. The remaining portion of the plume in the vicinity of MW1300 will not be addressed in the Interim Action, but covered in the SWOU RI/FS.

4. the AFCEE responses to the Department's comments on the Draft Action memorandum were presented in this Memorandum. Many of the responses were not adequate and the Department's comments still apply to this Memorandum. For example:

- Wellhead treatment of the Coonamessett Water Supply Well should be continued beyond October 31, 1997;
- Sampling and analysis of the Coonamessett River should continue past October 31, 1997 to monitor the effectiveness of the ETR system;

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from DEP

- Contingency plan should be established to provide Granular Activated Carbon (GAC) for more than the one irrigation well, if necessary;
- Clean source of clean irrigation water should be provided for the Augusta bog (instead of just isolating the reservoir from the river). AFCEE now proposes to provide a GAC if necessary, but the GAC is not funded;
- Water Management Plan should be provided for review as soon as possible for review with the Memorandum, and should contain analytical calculations on the potential effect the irrigation wells might have on the plume and private wells;
- The AFCEE must comply with the substantive requirements of the Water Management Act, even though permits are not required for the irrigation wells;
- The risk equivalent concentration should include fish ingestion pathway since there is conflicting information in the literature regarding the potential for EDB to bioaccumulate/bioconcentrate; and
- The Department does not advocate the use of flooding of the bogs as an institutional control to prevent further downstream migration. Although the flooding may reduce the migration of EDB contaminated surface water, it may enhance the migration of EDB contaminated groundwater.

Response:

- Wellhead Treatment of the CWSW will continue as long as the Town of Falmouth continues to utilize the well for a source of drinking water. Preliminary designs are being completed such that a final treatment facility can be constructed at the site. The raw water will continue to be sampled on a monthly basis for EDB and the decision tree recently presented to the RPM will be followed.
- The Coonamessett River will continue to be sampled past the interim action to evaluate the effectiveness of the action. The sampling will be revised as necessary and discussed in the Interim Action Draft Design Submittal which will present the 60% design of the system to the stakeholders.
- A sentence has been added to reflect that a GAC can be provided if EDB is detected in an irrigation well within 48 hours of the finding.
- A clean source of water will be provided to Mr. Augusta as necessary for irrigation. The source may be treated water from EW-1, the upgradient river, or a irrigation well equipped with a GAC unit. AFCEE will continue to sample the influent and the reservoir water to ensure that Mr. Augusta has adequate clean water for irrigation.
- The Water Management Plan has been renamed to include only the Fall Harvest activities and it will be submitted to the regulatory agencies on July 8 for review and comment. The influence of the irrigation wells on the plume has been added into the revised Draft Final Action Memorandum. In comparison to the influence of the river the transient nature of the irrigation wells would not effect the plumes.
- AFCEE believes that the irrigation wells have been installed in compliance with the Water Management Act. Only the three lower cranberry bogs have sufficient flow to be

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from DEP

regulated by the Water Management Act. It is our understanding that Mr. Handy must have his permit renewed within the next year.

- We do not believe that the fish ingestion pathway presents a realistic pathway. Our literature search reveals that EDB does not bioaccumulate, furthermore recent literature from EPA states that if the log octanol partitioning coefficient is less than 4 then they do not believe that it will uptake.
- Noted. The flooding of the bogs was deemed an interim or emergency response to reduce human health exposure to EDB. Flooding of the bogs was not proposed as a permanent solution.

5. The Department shares the concerns of the Cape Cod Cranberry Growers Association (CCCGA) regarding the negative impacts of the AFCEE response activities on the growers ability to cultivate their crop. The logistics of conducting response actions and cultivating cranberries have proven to be unworkable. For example, the installation of replacement irrigation wells has been delayed beyond the initial date of April 1, 1997; irrigation well pumps have failed; and an irrigation main line has been damaged. The Department has observed that these conflicting activities have not only impeded cleanup efforts, but also the growers do not have a reliable source of clean water for the crops. The Department reiterated its request for the Air Force to consider its authority under CERCLA to take impacted bogs out of service until the remediation system is proven to be effective.

Response: The initial date of April 1 was to provide a GAC unit on the irrigation well IG1 in the Baptiste Bog rather than have the irrigation wells installed and operational. The GAC unit was on line April 8 and the grower had surface water available that was not contaminated. It was not until after the first frost, that the agencies positions of that no EDB could be sprayed that AFCEE began to install irrigation wells to remove the growers from surface water. It should be noted that those growers using surface water above the MCL were placed into service first. AFCEE is committed to providing a source of clean water for the fall harvest and will continue to sample and analyze the river to ensure that public health and the environment are protected during the remediation. We believe that the bog operations can be conducted while the remediation system is put into place.

PAGE-SPECIFIC COMMENTS

1. Figure 15, Schedule of Unfunded Tasks. Please clarify the purpose of the proposed 10 monitoring wells (final item on Schedule) to be installed and developed from 1 Sep 97 to 03 Nov 97.

Response: The monitoring wells were to be installed as part of the SWOU, however with the recent detection of TCE in a residential well the number of monitoring wells has been increased. The revised SWOU schedule reflects the increased number of monitoring wells to be installed.

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from DEP

2. Figure 9. Please include the boundaries for the Ashumet Valley box model on this figure.

Response: The boundaries of the box model would be beyond the figure and would not be appropriate for this figure. The box model will be presented in the 60% design submittal or in other reports. The purpose of this figure is to show the approximate location of the wells being simulated in the model. No change is proposed.

3. Table 4, Summary of Modeling Simulations. Model runs A through E are balanced; each discharge the total volume of groundwater pumped minus 50 GPM. However, Model Run F, as written, pumps EW-001 and EW-002 equally for a total of 600 GPM, and reinjects 1175 GPM, which if consistent with other model runs, would require a 1200 GPM pumping rate for extraction. Please correct/clarify.

Response: The table will be revised such that EW0003B is extracting -400 gpm, IW001, and IW002 are injecting 400gpm and 325 gpm. 275 are being added to the river.

**Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments From MDPH**

GENERAL COMMENTS

1. We agree with and support the intent of this Action memorandum to “mitigate the exposure and potential exposure to a release or releases of EDB into the environment” (p. 6-1). Furthermore, we acknowledge and appreciate the steps that AFCEE has taken at the request of MDPH and the environmental regulatory agencies (e.g., to satisfy water needs related to agricultural practices).

Response: Comment noted.

2. In your response to EPA’s preliminary comment #8 (Appendix A, p. 7), you acknowledge that it is not possible to accurately model the hydrology of the Coonamessett River valley. Without a reliable way of predicting potential exposures, aggressive monitoring is necessary to address public health concerns until the opportunities for exposure have been eliminated. The detection of EDB this May in two private wells in the Hatchville area illustrates both the uncertainties in the hydrologic predictions and the need for an aggressive monitoring program. In our letter to you of March 6, 1997, we outlined that aggressive monitoring should entail weekly testing for surface and groundwaters, a continuous air monitoring network, and seasonal testing of cranberry fruit. The environmental sampling plan in the Action Memorandum falls short of these recommendations. Therefore, we feel that the proposed sampling plan will be inadequate to address citizens concerns and to assist ongoing health studies by ADSDR.

Response: Weekly surface water sampling is being conducted on the Coonamessett River. The sampling is being conducted near the locations where EDB has been found to be upwelling and at downgradient locations. An Appendix has been added to the revised Draft Final Action Memorandum to clarify the objectives, location and frequency of the sampling. Groundwater monitoring is also included in this table but with a frequency of monthly and quarterly testing.

Air monitoring is not proposed by AFCEE unless higher concentrations are found in the effected areas. We believe that more frequent sampling of the surface water is more prudent to protect public health. In addition, we ask that DPH review the latest test results for surface water and the air sampling to validate their model. Specifically, we suggest that the detection level achieved by the air sampling be put into the model to compute a CREG level. This would provide a basis for what can be reliably measured and would substantiate the surface water trigger levels.

We also request that representatives from DPH attend the weekly technical update. The weekly technical meetings have been a forum for the exchange of data with the regulatory agencies and until last week we believed that all of the information given to DEP was in turn being provided to DPH. Since learning that was not happening, we have taken steps to ensure that DPH has the latest validated data.

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments From MDPH

3. As we stated in our preliminary comments, the recent detection of EDB in the ambient air above the Broad River Reservoir highlights the need for a continuous air monitoring network around all the affected bogs and reservoirs. The results that you presented on May 21, 1997 indicated that the ambient air concentrations of EDB above the Broad River Reservoir were higher than what we predicted in our Technical memorandum. This contradicts your comment that our predicted concentrations overestimate the actual ambient air concentrations (Appendix A, p. 1). Because changes in wind direction and water management practices are difficult to predict, a continuous air monitoring network is the only way to take representative measurements of EDB in ambient air. Therefore, the limited air monitoring called for in the Action Memorandum should be replaced with a continuous air monitoring network.

Response: Additional air monitoring was conducted on May 28, 1997. These results were submitted to DPH on July 1, 1997 when it was determined that DEP did not forward these results. All of the air sampling from this event was determined to be non-detect. The first event conducted is still estimated because of the uncertainty of both the method and the lack of samples collected. However, the estimated result still is below the risk levels presented by DPH.

To further validate both the modeling and sampling, we are requesting that DPH use the detection levels from the recent sampling and work backwards in their model to determine the level of surface water and groundwater that could be reliably measured. Furthermore, we suggest that DPH review the latest surface water test results from the plausibly effected areas.

AFCEE will continue to monitor the surface water and groundwater for the protection of public health. Additional air monitoring is not proposed unless the surface water levels rise above 1.2 µg/L.

4. Risk assessment methodologies are often too narrow to adequately address public health concerns. The risk equivalent concentrations being used by AFCEE were derived for one chemical (EDB) and for specific exposure pathways (i.e., swimming, wading, cranberry bog worker). The risk assessment calculations do not consider the worst-case scenario where an individual is potentially exposed in all of these ways as well as through inhalation of EDB in the ambient air at his residence. Likewise, risk assessments cannot account for uncertainties in the duration and/or degree of exposure to EDB in the past. Finally, the risk equivalent concentrations do not consider opportunities for exposure to the other chemicals in the FS-28 plume besides EDB (p. 2-7).

Response: EDB is the Contaminant of Concern for the leading edge and other constituents are not considered since they are not above the maximum contaminant level. Inhalation in the residences was not considered since there is no exposure or completed pathway for this exposure. For conservatism, the integrated receptor includes a life-time exposure, whereas the risk decision tree is more of a short-term exposure. AFCEE will

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments From MDPH

be conducting a Baseline Risk Assessment for the SWOU RI/FS and this will include the leading edge of the plume at Thomas B. Landers Road.

For past exposures to EDB and other chemicals, AFCEE is relying on DPH and ATSDR. These issues cannot be addressed solely by AFCEE.

5. Responses to public health concerns must integrate many different types of information (e.g., analytical measurements, citizen concerns, uncertainties, available health data). In contrast to this, the Surface Water Decision Tree (Figure 8) considers only analytical measurements of EDB in surface water and risk equivalents concentrations in the decision-making process. Therefore, we feel that the Surface Water Decision Tree should only play a supporting role for decisions about public health interventions.

Response: Comment noted.

6. MDPH fully supports the need for: the completion of a focused feasibility study for the entire plume; selection of a final remedy; and groundwater sampling and analysis at the leading edge and within the plume (p. 9-2). These are critical pieces of the plan to eliminate opportunities for exposure to EDB in the Hatchville area of Falmouth. We sincerely hope that funding can be made available for these crucial items. The lack of dedicated funds for these important tasks undermine expectations for the rapid institution of an effective final remedy.

Response: A schedule for the RI/FS is presented and AFCEE is committed to seeking a final remedy. However, while the final remedy is being investigated, both a time critical removal action and interim action will be conducted by AFCEE to capture the portion of the plume that is upwelling into the Coonamessett River. The goals and objectives for completion of these actions are provided in the revised Draft Final Action Memorandum.

SPECIFIC COMMENTS

1. MDPH did not concur with the conclusions of AFCEE's risk assessment concerning the flooding of the cranberry bogs for winter protection (p. 2-11). Instead, MDPH used AFCEE's risk assessment and other information to conclude that flooding the bogs over the winter would not present a public health concern. MDPH also asked AFCEE to identify homes that had experienced flooding from this activity in the past and to take steps to prevent this from happening again.

Response: The sentence will be revised to reflect that MDPH used the risk assessment and other information to conclude that flooding the bogs over the winter would not present a public health concern.

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments From MDPH

AFCEE did identify one home that is flooding during the winter. AFCEE took the following steps:

The basement of the home on Thomas B. Landers was surveyed in relation to the bog and found to be 1.7 feet higher than the non-flooded river elevation, thus if the bog elevation during flooding raised more than 2 feet it was possible that the basement could be flooded by groundwater. Surface water could not enter the basement since the bog dike near the home was 0.5 feet higher than the downgradient weir for the bog. Thus, EDB in the river could not enter the basement.

Secondly, AFCEE sampled the groundwater below the house using a shallow drive point. No EDB was detected from this sample and the water level prior to flooding was within 0.5 feet of the foundation.

Third, AFCEE sealed the unfinished hole left in the concrete floor in an attempt to block groundwater from coming into the area. A plastic pipe was left in place to relieve pressure beneath the patch.

When AFCEE was informed that water was entering the basement, Jacobs Engineering responded and assisted with pumping out water and collected both a water sample and air sample. No EDB was detected in the sample but low levels of VOC were found. The VOCs were attributed to the storage of household products (paints, lawnmower, etc.) since the samples were taken from the floor. The bog operator installed a sump pump and piping for the basement.

2. Please provide the number and locations of samples from the FS-28 plume that AFCEE has analyzed for vinyl bromide (p. 2-11).

Response: All samples are being analyzed for vinyl bromide since the conclusion of the MDL study in December, 1996.

3. Prior to the autumn harvest, MDPH will test the cranberry fruit but not the cranberry vines (p. 2-14).

Response: Testing of the vines will be removed from the text.

4. In our preliminary comments, MDPH asked for a detailed justification for the omission of the fish ingestion pathway from the surface water risk assessment. AFCEE's response to this comment (Appendix A, p. 2) acknowledges that studies to assess the importance of this exposure pathway are ongoing. Therefore, we reiterate that it seems premature to eliminate this pathway until all the relevant studies have been completed.

Response: Comment noted.

5. Please clarify whether the sampling program for Broad River Reservoir is funded or unfunded. The listing of funded projects on p. 9-1 contains the Broad River Reservoir

**Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments From MDPH**

sampling but it is reported to be unfunded elsewhere (p. 5-10, p. 5-14). Also, please explain the references to a Coonamessett Pond sampling program on Figure 15.

Response: Sampling of Broad River will be conducted to evaluate ecological impacts of the removal and interim action. An Appendix has been added to clarify the objectives, location, analytes, and frequency of sampling for Broad River.

Sampling of the Coonamessett Pond shown in Figure 15 is part of the SWOU RI. Data quality objectives for the sampling are addressed in the FS-28 RI/FS Workplan. This workplan will be re-issued as a Draft Final for the SWOU RI/FS and the revised plan will include a sampling of the ponds. The Coonamessett Pond was sampled by the Falmouth Board of Health in May, 1997.

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from EPA

GENERAL COMMENTS

As a threshold matter, we would like to express our dissatisfaction with the overall development of this response action. In our view, the Action Memo has resembled a "moving target," with basic elements of AFCEE's strategy changing on a weekly, sometimes daily, basis. In many cases, our RPMs have had little if any notice of such changes and the justification for making them. Moreover, both the draft and draft final versions of the Action Memo have differed in significant aspects from the plan AFCEE orally presented to the RPMs preceding submittal. This has made our review and comment on the Action Memo exceedingly difficult.

The following summarizes EPA's "big picture" concerns regarding the Action Memo:

1. Several significant components of the response action are listed as "unfunded." These unfunded activities include treatment system upkeep (EW-1), installation of other extraction/reinjection wells (EW-2 & 3), groundwater sampling, and preparation of a final Action Memo. This is unacceptable. AFCEE should take immediate steps to secure the funds needed to undertake all phases of this removal action.

Response: Funding issues have been eliminated from the revised Draft Final Action Memorandum. Funding issues will be resolved in a separate letter to be provided by AFCEE. The revised Draft Final Action Memorandum presents the complete picture to be protective of human health and the environment. Revised schedules and dates are proposed for a time critical removal action (EW-1) and an Interim Action. The interim action is an engineered system that builds on data collected through the operation of the removal action.

2. It is unclear how the response action will ensure that a clean supply of surface water will be available by September 15, 1997 per the action memo, while the Cape Cod Cranberry Growers letter of June 10, 1997 clearly indicates that clean water is required by September 1, 1997. We note that surface water treatment in the Broad River is no longer a part of the action, except as part of a potential water management pilot test this summer. Moreover, we do not believe there is sufficient information to assess whether the proposed ETR system will effectively prevent upwelling of EDB in the river system. We note that while the Air Force committed to have clean sources of irrigation water on-line by April 1997, as of June 10th, several of the new irrigation wells were not yet operational. There is considerable uncertainty as to whether the response actions can fully address the needs of the cranberry growers.

Response: The Water Management Plan has been renamed to a Fall Harvest Plan. AFCEE is committed to full implementation of the plan by September 1, 1997. Although there are many risks to the proposed plan, the goal is to provide clean water for the harvest by treating the Coonamessett River below the point of where EDB upwelling. We believe that this is the only way to reliably obtain clean water for the harvest. The

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from EPA

ETR system would not be on-line soon enough to control the upwelling for this years harvest.

Only one location (Reservoir Bog) remains to be replaced with an alternate irrigation water supply. The well has been installed, but the current pump location does not have adequate suction at its present location. We are working with the bog operator to re-locate the pump and anticipate completion of this task by July 25, 1997.

3. Representatives from the Process Implementation Team and Long Range Water Supply Teams have questioned why the Air Force is allowing use of "treated" water when the policy adopted by both these teams and provided to the Senior Management Board clearly states a preference for clean water as the first viable alternative. EPA recommends the Air Force respond in writing to the PIT/LRWS teams on this key issue.

Response: Comment noted. As discussed during several RPM meetings we do not believe that this is a policy adopted by AFCEE. A letter will be drafted to PIT/LRWS to clarify the issue of using treated water.

4. The Action Memo indicates that certain activities terminate on October 31, 1997 (e.g., operation of the Coonamessett Water Supply Well treatment system, irrigation well sampling, and treatment system upkeep). Why aren't these actions scheduled beyond this date? These response actions must be continued until a permanent ETR system for the EDB plume is in place and is shown to be operating effectively. Otherwise, EPA does not believe this response action will be fully protective of human health and the environment.

Response: These were shown in this manner to reflect contracted effort which does not currently extend beyond the current fiscal year. The work has been budgeted in FY98. All funding/unfunded issues have been removed from the Action Memorandum. These will be covered in a separate letter by AFCEE.

PAGE-SPECIFIC COMMENTS

1. Page 2-5, last paragraph. The paragraph states that, "In response to the discovery of EDB-contaminated ground and surface waters in the Hatchville community, AFCEE took immediate actions to eliminate any exposure or potential exposure to EDB. These actions, some of them ongoing, include:

- "Installation of a wellhead GAC filtration system on Falmouth's Coonamessett Water Supply Well."

This is a bit misleading. First, this action was not taken "in response to the discovery of EDB-contamination in the Hatchville community." This action was taken in response to a detection of EDB from a sample collected in the water supply well that was later found to be non-detect. The continued use of GAC on the well is a precautionary measure necessitated by the modeling results of the plume north of Coonamessett Pond which

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from EPA

show the upper, deeper portion of the EDB plume reaching the water supply well possibly within the next six months.

Response: Text will be revised as suggested.

2. Page 2-8, last paragraph. This paragraph states that, "The water pumped from Falmouth's Coonamessett water supply well is filtered by a GAC system...." And goes on to say, "The filtered water produced from the water supply well is critical to the town's water supply system...."

This office is very concerned that there is no mention of the AFCEE's continued operation and maintenance of the GAC system in either the schedule of funded task or schedule of unfunded tasks attached to the draft Action Memorandum. As a matter of fact, the first bullet on Page 9-1 indicates that AFCEE's continued operation and maintenance of the water supply well will continue until October 31, 1997. In light of the modeling results which reveal the plumes potential impact on the water supply well, and the fact that EDB was recently discovered at monitoring well 1279B just upgradient of the Coonamessett water supply well, it is imperative that this work continue through the completion of the RI/FS for the SWOU.

Response: Operation and Maintenance will continue on the water supply well as long as it is utilized by the Town of Falmouth. AFCEE intends to turn the O&M over to the Town once a permanent system is online. Preliminary engineering is being conducted in cooperation with the Town of Falmouth. The schedule has been revised to show the continued O&M of the wellhead treatment. AFCEE intends to turn the O&M over to the Town of Falmouth once a permanent system is constructed. AFCEE will continue involvement through the completion of this system and the SWOU RI/FS.

3. Page 2-9, Section 2.2.2, Second bullet. The text states that bottled water is supplied to the 35 residences "on a biweekly basis." Is this correct or is bottled water supplied as requested; please clarify.

Response: Bottled water is being delivered on a biweekly basis by a water distributor. However, if additional water is requested it is delivered as needed to the homeowner.

4. Page 5-1, Section 5.1. This section is misleading. While it lists the actions being proposed in the Action Memorandum (and have proposed dates outlined in the schedule section), many of these are currently unfunded and may not be implemented. It is imperative to the successful containment of this plume that the activities outlined in the section be funded as soon as possible.

Response: Funding issues have been removed from the revised Draft Final Action Memorandum.

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from EPA

5. Page 5-1, Section 5.1, sixth bullet. This section lists the actions being proposed in the Action Memorandum. The sixth bullet indicates that, "As part of Phase I, the extraction well (60EW001) and the existing irrigation well (69IG0001 - also known as the "Handy well") will be fitted with submersible pumps and temporarily plumbed to a mobile carbon system located in the bog." In addition, AFCEE will provide the necessary electrical power and associated equipment to operate an ETR system.

The action memorandum should not include the hookup of the handy irrigation well to the mobile carbon system as a "proposed" action since this was done several months ago. In addition, it is unclear whether Handy's irrigation well will actually be used as part of the ETR system. We were previously lead to believe that this well would be an important component in an effective ETR system for the toe of the FS-28 plume. This well does not seem to be part of the proposed ETR system. Also, it is unclear in the proposed schedule what the system startup dates are for each of the proposed extraction wells. Will the extraction wells be turned on at the end of the "procurement and installation of pumps" activity, e.g. EW-1 - July 2, 1997 or EW-2 and EW-3 - September 1, 1997.

Response: Hookup of the Handy well (IG1) will be deleted from the proposed action. The Handy well will not be used in the ETR system. Intuitively, the well is not deep enough to fully influence and capture the plume. Model simulations will be performed using a deeper well near its location to evaluate the effectiveness of a deeper well at this location.

The schedule has been revised to show startup of the Time Critical Removal Action and the Interim Action. Engineering designs must be completed if more than two wells are connected and if the system is to be operational continuously as discussed during the meeting with the RPMs on June 30, 1997.

6. Page 5-1, Section 5.1, seventh bullet. This bullet indicates that the Phase II of the proposed remediation will be the installation of one or two additional extraction wells. The "Schedule of Unfunded Tasks" in Figure 15 indicates that extraction wells EW-2 and EW-3 will be procured and installed by September 1, 1997.

The funding and implementation of this phase of the remediation project must be expedited. The RPMs were informed at a recent RPM meeting that the installation of these two additional extraction wells is a critical component of an effective remediation system in this area of the plume as it is these two wells that would prevent upwelling from occurring. (EW-1 would capture the "hot spot" in the area north of the Baptiste bogs near MW-1284.)

Response: Comment noted. The schedule presented in the Draft Final assumed that EW-2 would be coupled with surface water treatment of the Broad River to reduce the upwelling and provide clean water to the downgradient users. However, this method still had many uncertainties and a portion of the upwelling plume may not be captured. Hence, it was determined that the only safe and reliable method for providing clean water

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from EPA

was to filter the river water below the point where EDB is upwelling in the Baptiste Bog. The wells would meet the long-term objective of controlling the upwelling but not be effective in the short-term. The interim action will require engineering design and evaluation of the results collected from the removal action.

Funding issues have been eliminated from the Action Memorandum.

7. Page 5-3, Extension of Public Water Mains. Based on recent information, has the extent of the public water main extension increased? If so, please revise this section and Figure 6. At present, the text and Figure 6 are inconsistent since neither John Parker Road, Route 151 or Cranberry Lane are shown on the Figure as areas where the public water mains are to be extended.

Response: Water mains on Boxberry Hill and Strand Way are being added to the project. The figure will be revised to reflect these additions. Water mains and curbstops already exist on John Parker Road and Cranberry Lane and no extensions are required. Additional text will be added to clarify this issue. Route 151 will be added to the Figure.

8. Page 5-4 and Page 5-5, Groundwater Extraction, Treatment, and Discharge System. There seems to be a deletion of any reference to an "extraction, treatment and reinjection" system and the addition of references to an "extraction, treatment, and discharge" system. This implies that AFCEE has moved away from the reinjection of treated water and is evaluating the discharge of treated water into the river system (Coonamessett and Broad).

The discussion in this session seems to imply that the ETR (or ETD) system would not be up and running until the entire system (Phase III) is designed and implemented. The last paragraph on the top of page 5-5 states that, "The final phase will consist of developing and constructing a permanent system to capture the plume before upwelling and mitigate the levels of EDB in the surface water." Although the first paragraph on page 5-6 states that the Phase I observation approach will allow remediation to begin immediately while the long term solution is being developed, this paragraph seems to suggest that Phase I and II activities are not going to be implemented on a continuous basis, but will be part of a system "evaluation" process. This is unacceptable and should be clarified.

References are made to treatment plant sizing which ranges from 600 to 1200 gpm. Please clarify design criteria for Phase I and Phase II operation and include a schematic diagram of the proposed treatment train for each phase. In addition, advantages and disadvantages of enclosing the treatment train and/or including additional treatment units (i.e., backwash equalization tanks) should be discussed.

Response: The Time Critical Removal Action will be operated continuously and the text will be clarified. The removal action will be performed by extracting groundwater at 600 gpm, treating the water in a GAC Unit, and discharging the water to either Broad River or the Coonamessett River. Flow diagrams and a 60 % design will be submitted as a Draft

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from EPA

Design Submittal for the interim action. No schematics will be presented in the Action Memorandum. Design criteria will be provided following the evaluation of the data collected from the removal action. This data will be submitted as it is collected and compiled in the Draft Design Submittal for public comment.

9. Page 5-7, second and third paragraphs. These two paragraphs discuss the short- and long-term objectives for the modeling effort which focus specifically on improving the effectiveness of the proposed treatment system. There is no discussion on evaluating the potential impacts on the plume from operation of the ETR system or increased demand on the aquifer from the installation of nine new irrigation wells.

Response: A discussion of the impacts of the ETD system will be added. This discussion will focus on the five surrounding areas (adjacent wetlands, vernal pool, rivers (Broad and Coonamessett), the active cranberry bogs, and the abandoned cranberry bogs. Sampling objectives, locations, and frequency are provided as a Appendix to the revised Draft Final Action Memorandum. A discussion of the irrigation impact to the plume and withdrawal has been added to the revised Draft Final Action Memorandum. The irrigation wells in comparison to the river have little influence on the plume migration since they operate infrequently and the withdrawal from the aquifer is negligible in comparison to the quantity of the water discharged from the aquifer to the river.

10. Page 5-8, Water Management Practices. There doesn't appear to be any reference to treatment of surface water in the area of the Broad River as presented in the original Action memorandum and as discussed at the May 21, 1997 meeting at the DEP in Lakeville. While the revised Action Memorandum does state that "means for providing clean water for flooding will be on-line by September 15, 1997," specific treatment of surface water in the area of confluence of the Coonamessett River and the Broad River is stated as something that AFCEE may do (versus something that AFCEE will do as stated in the original draft).

The plan developed for water management should not be limited to addressing the autumn bog flooding season. Since a final remedy has not been developed, the plan must address long term bog operations on a year-round basis. In addition, the plan must include a mechanism for periodic updates based on observed field conditions and the operational effectiveness of interim actions.

Response: Due to the time constraints for providing clean water for the Fall Harvest the plan is limited to the Fall Harvest. Winter flooding and year-round operation must be prepared as addendum to the Fall Harvest Plan. At present, AFCEE does not foresee the need to filter the water for the winter flooding unless the levels of EDB are above the risk levels presented in the Surface Water Decision Tree. Flooding of the Thompson Bog, however, presents unresolved issues since an adjacent home was flooded with groundwater last January. A sump and pump have been installed in the basement by the bog operator.

**Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from EPA**

The Harvest Plan includes sampling that will be conducted to ensure the availability of clean water for the fall harvest. Updates will be provided at the weekly technical meetings.

11. Page 5-11, Groundwater Sampling. A performance monitoring plan must be developed and funded to assess the effectiveness of the Phase I and Phase II ETR systems. The plans should incorporate use of existing monitoring wells and surface water gauging stations, if feasible.

Response: Performance monitoring is summarized and described in the new Appendix of the revised Draft Final Action Memorandum. Additional performance monitoring will be addressed in the Draft Design submittal for the Interim Action. Monitoring will include existing monitoring wells and the surface water gauging stations.

12. Page 9-2, Section 9.0, Recommendations. Items listed as recommended if additional funds become available must be funded as soon as possible.

Response: Comment noted. Funding issues have been removed from the revised Draft Action Memorandum.

13. Figures 14 and 15 Schedules of Unfunded and Funded Tasks. This office is concerned that schedule of unfunded tasks indicates that "treatment system upkeep" will end on October 31, 1997. The operation of the ETR system should extend well beyond this date. While the flooding of the bogs appears to keep the EDB from entering the bogs (reduction in upward vertical gradients), the continued discharge of the plume in a location further downgradient in the Coonamessett River is unacceptable.

Response: Comment noted. As previously stated the funding issues will be removed from the revised draft Action Plan. The dates ended on October 31, 1997 since the work is currently not contracted. Many of these tasks are budgeted for FY98.

14. AFCEE responses to EPA comments May 2, 1997 on draft action memo. This office has reviewed the responses to EPA comments on the previous draft action memo and has the following comments:

- The Water Management Plan, which was scheduled to be issued in mid-June, should be submitted to this office for review.
- Comment 3, regarding the feasibility of modeling the potential effects on the new irrigation wells, must be discussed further.
- Comment 5, regarding the lack of funding for various activities beyond October 31, 1997, has not been responded to adequately and is reflected in previous comments on the revised action memo.

Responses to Comments on Draft Final FS-28 Action Memorandum
Issued June, 1997
Comments from EPA

Response: Water Management Plan will be submitted on July 8, 1997. The plan will only address the Fall Harvest at this time. A supplement will be prepared to address the winter flooding and other year-round operations of the bogs. However, AFCEE does not intend to continue filtration of the river for the winter flooding unless the levels in the river are above the 10^{-4} REC presented in the Surface Water Decision Tree. Discussion of the irrigation wells has been added to the revised Draft Final Action Memorandum.

Funding has been addressed in other comment responses above.

**DEP COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

GENERAL COMMENTS

1. The Department supports the proposed Time Critical Removal Action to begin the cleanup of the EDB contaminated groundwater at the FS-28 plume. Additionally, the Department supports an Interim Action to address the portion of the plume downgradient of Hatchville Road.

Response: Comment noted.

Resolution: Agreed

2. In a meeting among the Department, EPA, and AFCEE on June 30, 1997, AFCEE agreed that the Interim Action may include several extraction wells in addition to EW-2 and EW-3, and may be designed to capture the plume downgradient of Hatchville Road as far south as monitoring well MW1300. Please incorporate this conceptual design into the discussion of the Interim Action, and include a more detailed schedule through system startup.

Response: At this time, AFCEE is proposing to prepare the conceptual design of the interim action as part of the evaluation and modeling report. This report could resemble an Engineering Evaluation and Cost Analysis (EE/CA) and would be available for public comment. Further remediation of the plume outside the influence of EW-1 could have adverse ecological impacts which could effect the nearby certified vernal pool, cranberry bogs and the wetlands. The analysis would use and incorporate the EW-1 results as the plant continues to operate.

Resolution: The MMR RPMs need to define the direction of the interim action and how it will be handled. Jacobs indicated that the implementation schedule for the interim action is not possible since a site has not been found and due to the ecological concerns voiced during the Fall Harvest and discharge of treated water to the Coonamessett River. The conceptual design report proposed above could be utilized as a decision point if interim action is required prior to the completion of the SWOU RI/FS.

It was agreed during comment resolution that the Final Action Memorandum will focus more clearly on the Time-Critical removal actions, and that the details for the interim action will be addressed separately in the conceptual design report. Furthermore, it was agreed that the interim action would focus on the portion of the plume upwelling and the portion that has been referred to as MW1300.

3. Report figures supporting the text are frequently incomplete, at differing scales, and depict differing segments of the study area with few easily identifiable landmarks or inset maps depicted to enable the reader to quickly identify where the area shown is in the

**DEP COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

larger site study area. Please subject all figures and tables to a close quality assurance/quality control (QA/QC) review, and reevaluate the information presented in terms of how well the graphics and tabular data support and illuminate the text.

Response: The variation in scales and segments of the study area shown in the figures is intentional. The figures are intended to illustrate and clarify the text. In each map, road names have been labeled to provide geographical reference. In some cases, extraneous information is omitted to more clearly illuminate the subject of the figure. (For example, bog names and surface water sampling locations are not shown on Figures 3, 7, 9, and 11, which serve the purpose of showing the location of monitoring wells, air sampling points, water supply extensions, and simulated extraction/injection locations, respectively.) To clarify and complete the figures, however, the following changes will be made:

- A scale and north arrow will be added to Figure 2 "Site Location".
- "(See Table 1)" will be added in the legend on Figure 2 "Site Location".
- Sandwich Road will be labeled on Figure 3 "FS-28 Action Memorandum Recently Installed Monitoring Wells and Existing Irrigation Wells".
- Hatchville and Turner Roads will be labeled on Figure 5 "Interpreted Area of EDB Discharge to the Surface".
- "Sam" will be removed from Turner Road on Figure 6 "Geologic Cross-Section A-A' of FS-28 Plume".
- Extraction well EW-1 will be added to Figure 6 "Geologic Cross-Section A-A' of FS-28 Plume".
- Figure 13 "Ecological Sampling Areas" will be replaced with an updated figure showing exact ecological impact sampling locations.

Resolution: Agreed

PAGE-SPECIFIC COMMENTS

1. Section 1.0 Purpose, page 1-1: Although the FS-28 plume was not originally included as part of the Record of Decision for Interim Action (1995), the plume has been included as an amendment to the Federal Facility Agreement dated April 24, 1997. Please revise the text accordingly.

Also, as stated on page 1-2, "Public water supply is being provided...". This is not correct. Public water will be supplied sometime in fall 1997. Please correct the text.

Response: The text referenced on page 1-1 will be revised as follows: "The FS-28 plume was not included in the Record of Decision for Interim Action (Stone & Webster 1995) which addressed six of the plumes emanating from the MMR, however it was included in the amendment to the Federal Facility Agreement dated April 24, 1997. In May 1996, AFCEE assumed management of the Installation..."

**DEP COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

The sentence on page 1-2 will be revised per comment.

Resolution: Agreed

2. Section 2.1.4 Release or Threatened Release of Contaminants into the Environment, page 2-6: This section indicates that there have been several contaminants in addition to EDB detected in the groundwater. Please either prepare figures depicting the distribution of these contaminants or include text indicating that no discernible pattern exists.

Response: The sentence at the end of the third paragraph in Section 2.1.4 reads "These VOCs may be associated with the FS-28 plume; however, a strong correlation has not been established." The fourth paragraph also suggests that the chloroform, manganese, and SVOCs detected at low levels in Hatchville are not considered to be contaminants of concern in the FS-28 plume. Further evaluation of the constituents will be conducted during the SWOU RI/FS which will include the leading edge of the plume and the data collected to support the Time-Critical Removal Action. No change to the text is proposed.

Resolution: Agreed

3. Section 5.1.1.1 Operation and Maintenance of the CWSW Wellhead Treatment System, Page 5-2: It is the Department's understanding that the Town of Falmouth may be sampling the CWSW weekly for EDB and VOCs. The Department recommends that AFCEE also utilize these data in its evaluation. Please revise the text accordingly.

Response: The text which reads "...the raw water supply and three sentry wells are sampled on a monthly basis for EDB." will not be revised, because it describes the actions being taken by AFCEE. However, AFCEE will use all available data for evaluation of the plume's affect on the well and vice versa.

Resolution: As a point of clarification, this data has been requested from the Town of Falmouth but it has not been received as yet. AFCEE will continue to work with the Town to obtain this data, however the usability of the data must be closely evaluated during the risk assessment.

4. Section 5.1.1.4 Time Critical Removal Action, Page 5-6: As stated in the Action Plan, the Time Critical Removal Action treatment is designed to "remove EDB to concentrations below reporting limits...the reporting limit for EDB is 0.02 µg/L". However, as stated in the Plume Response Decision Criteria developed cooperatively between the U.S. Environmental Protection Agency, AFCEE, and the Department, included as an amendment to the Federal Facility Agreement (FFA) dated April 24, 1997, one of the goals of the design to capture the groundwater plume is treatment of contaminants and cleanup of the plume to background levels if technically and economically feasible. Background levels for EDB is assumed to be non-detect; the

**DEP COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

detection limit to date for EDB has been 0.0039 µg/L while the reporting limit has been 0.005 µg/L. Please revise the text accordingly.

Response: For clarification, the reporting limit for EDB using EPA Method 504.1 is 0.01µg/L. The detection levels (MDLs) for EDB at the field laboratory and the fixed-base laboratory are 0.005 and 0.0039 µg/L, respectively. AFCEE has committed to removal of EDB concentrations to non-detect, if technically and economically feasible, with the reporting limit (PQL) of 0.01. The discussion in Section 2.2.1 makes this clear. Using levels less than the reporting limit would not be practical since there is a potential for false positive results.

“... MDL studies reflect “ideal” instrument operating conditions and frequently have values that are lower than the laboratory and instrument can confidently report in environmental samples. The practical quantitation limit (PQL) or RL is defined by AFCEE (AFCEE QAPP, version 1.1, February, 1996) as “the lowest level that can be reasonable achieved within specified limits of precision and accuracy during routine laboratory operations.” The PQL should be considered a routinely achievable detection limit with a relatively good certainty that any reported value is reliable.

Resolution: Clarification will be added to the text when the subject is discussed, to indicate that values between the Detection Limit and the PQL are reported as estimated. In accordance with data validation guidelines these will be flagged with a “J.”

Further clarification on this issue is required, in general, by the RPMs. When AFCEE says, for example, that “groundwater will be treated to remove COCs to non-detect,” do they mean the detection limit or the reporting limit? The issue will need to be resolved by the RPMs

5. Section 6.0 Expected Change in the Situation Should Action be Delayed or Not Taken, page 6-1: As stated, the DEP has “prohibited the use of the Coonamessett Water Supply Well (CWSW) without the wellhead treatment for EDB”. To clarify, the Department requires the wellhead treatment as a precaution against a detect of EDB. To date, EDB has not been detected in the CWSW water. Please revise the text accordingly.

Response: The first sentence in the second paragraph of Section 6.0 can be replaced with the following: “The DEP requires the wellhead treatment as a precaution against potential contamination of the public water supply with EDB.” The intent of the paragraph is to express that without the continued treatment, the well cannot be used, and water shortages may occur. The analytical results are not relevant to the section.

Resolution: Agreed

6. Figure 2: This figure identifies only 3 of the 9 existing irrigation wells; does not include the proposed or existing extraction wells or monitoring wells; and points out S-1

**DEP COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

through S-7 without identifying what they are in the legend other than “Map Number” which is neither self-explanatory nor explained in the text. Also lacking are a north arrow and a scale. Please revise and complete this Figure and revise the text as necessary to adequately support the Figure.

Response: The purpose of Figure 2 (when first referenced in Section 2.1.2) is to show the locations for the actions discussed in the memorandum. The figure shows 3 existing (prior to 1997) irrigation wells. The 9 new irrigation wells, as well as the 3 “existing” irrigation wells are shown on Figure 14. When referenced again in Section 2.1.3, Figure 2 is intended to accompany Table 1, and is suggested in the text (“Table 1 presents a summary of the agricultural water usage for the affected bogs shown on Figure 2.”). The locations shown on the figure (S1 through S7) are listed in the first column of Table 1, and footnoted “See Figure 2.”

For clarification, the following changes will be made:

- “See Table 1” will be inserted in the legend next to the symbol for map number
- The north arrow and scale will be added.

Resolution: Agreed

7. **Figure 3:** Please include the bog names to clarify the locations being depicted.

Response: The Baptiste, Augusta, Adams, and Thompson bogs will be identified on the revised figure.

Resolution: Agreed

8. **Figure 15:** Please update this schedule to reflect recent agreements for the FFA enforceable schedule for FS-28, Interim Action, and the Southwest Operable Unit (SWOU).

Response: Comment Noted. Enforceable dates will be added to the schedule as they are negotiated with EPA.

Resolution: Agreed

DEP COMMENTS ON THE DRAFT FS-28 MONITORING PLAN

GENERAL COMMENTS

1. At a meeting among AFCEE, the Department, DPH, and EPA, on July 10, 1997, AFCEE agreed to conduct additional air sampling at Reservoir Bog and Broad River. The Monitoring Plan should be updated to reflect this agreement. Additionally, a meeting among these agencies is scheduled to take place in the next few weeks to discuss the need for additional air monitoring. Please revise the text to indicate that the monitoring plan may be updated as needed.

Response: Agreed. The monitoring plan has changed since the Revised Draft Final FS-28 Action Memorandum was issued. The most significant changes include the removal of performance monitoring for the Fall Harvest Plan, the addition of air sampling, and significant changes to the ecological impact sampling and analysis program.

Resolution: Agreed

PAGE-SPECIFIC COMMENTS

1. Section 3.0 Performance Monitoring, Pump Test Startup Page 3: Please identify the variables and calculations performed to arrive at the proposed 600 GPM pumping rate for the test as well as the estimated 300 ft. radius of 0.5 ft. drawdown. Additionally, please justify the selection of pump test observation well locations and depths utilizing cross sections that include the wells listed in Table 1-2.

Response: The pumping rate was established to capture the majority of the plume at Hatchville Road. Modeling runs were performed which verified that the 80 percent of the particles seeded at Hatchville could be captured. The radius of influence is based upon the model runs.

The monitoring rationale for each screen scheduled for continuous recording is provided in Table C-7. There is an adequate distribution of observation screens in three dimensions surrounding the extraction well to meet the objectives of the pumping test. With the exception of four piezometers installed for the purpose of monitoring the effects of deep groundwater extraction on the shallow groundwater near the pumping well, these wells and piezometers were located and installed during the remedial investigation. Because the tables summarizing manual and continuous record stations provide both the radial distance from the extraction well and the screen elevation, cross sections are not required to demonstrate that the coverage proposed is adequate.

Resolution: Agreed

**DEP COMMENTS ON THE
DRAFT FS-28 MONITORING PLAN**

2. Section 3.0 Performance Monitoring, Pump Test Startup, page 5: Although AFCEE notes that the test will not be initiated during a rain event, or prior to a forecasted storm, there is uncertainty in predicting the weather. Please include precipitation measurement capability as part of the pump test to permit for later data correction, if necessary.

Response: Agreed.

Resolution: Agreed

3. Section 4.0 Ecological Impact Monitoring, page 7: Recently the Department was provided with an updated ecological monitoring plan; please include this update in the Performance Monitoring Plan. The Department requests a detailed plan to include the entire stretch of the Coonamessett River from Hatchville to Great Pond, a schedule for the Ecological Impact Monitoring Plan, and recommends that the monitoring plan be similar in structure to those currently underway for FS-12, SD-5, CS-10, Ashumet Valley, and LF-1. Additionally, the Department recommends that the Technical Review and Evaluation Team (TRET) have the opportunity to review and comment on the proposed ecological impact monitoring plan. Finally, the Department recommends that the concerns raised at the August 26, 1997, bog tour concerning the potential drawdown effect of the EW-1 on the Coonamessett River water level and subsequent impacts to fish runs be incorporated in the monitoring plan.

Response: Comment noted. We do not see a need to prepare a separate ecological monitoring plan, since the majority of the information is included in the Action Memorandum. The analytical parameters have been adjusted to be consistent with the other ecological evaluations being conducted by AFCEE.

Groundwater and stream levels will be measured during the operation of extraction well EW-1. A total of 47 screens will be monitored during the first few weeks of groundwater extraction, 26 of which will be monitored continuously. In addition, stream discharge and stage will be measured in the River at seven locations during the next few months. The Falmouth Conservation Commission has requested that the data collected be forwarded to the fisheries groups to determine the impacts to the herring run. AFCEE is also concerned with the drawdown effects of EW-1 which is why the water level measurements are being taken around the well. These concerns are also valid for any future extraction well such as EW-2 and EW-3. These new wells are planned to intercept more of the plume before upwelling into the river, however, it is likely that these potential wells will have more of an impact on the ecological system since they will likely be shallower than the EW-1 well.

Resolution: Agreed

**DEP COMMENTS ON THE
DRAFT FS-28 MONITORING PLAN**

4. Table 1-1 Risk Management Monitoring: It is the Department's understanding that AFCEE is conducting weekly monitoring of the private wells at the two residences that had one previous detection of EDB. Please clarify and revise the table as needed.

Response: Table will be revised per comment.

Resolution: Agreed

5. Table 1-2 Removal Action Performance Monitoring: Please clarify the duration of the "evaluation period" to monitor the effect of the groundwater extraction on downgradient EDB concentrations. The Department is unable to comment on the appropriateness of the monitoring frequency without the definition of the evaluation period.

Response: The evaluation period will be a period of approximately 2 months. Additional text will be added to reflect that the evaluation period will be at least one month but not longer than 2 months. Also, evaluation of the removal efficiency and other factors will be continually reviewed during the operational phase of the system.

Resolution: Agreed

6. Table 1-3 Ecological Impact Monitoring: The Department requests a more detailed Ecological Impact Plan for the Time Critical Removal Action in order to comment.

Response: The detailed ecological impact sampling and analysis plan was presented at the August 14, 1997 technical update meeting, and had been previously faxed to the DEP and EPA. The plan was also presented to the JPAT on August 13 and included in the NOI application which submitted to the DEP.

Resolution: Agreed

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

UNRESOLVED COMMENTS

I. Issues from EPA Comments dated June 20, 1997

1. General Comment #1 - Per EPA's August 27, 1997 correspondence, certain "key" activities included in the revised schedule and dates proposed in Figure 15 should be added to the FFA enforceable schedule.

Response: Comment noted. Key activities will be added as necessary to reflect FFA enforceable milestones. These have not been presented in a letter to AFCEE.

Resolution: It has not yet been resolved exactly which dates should be added to the FFA enforceable schedule. This issue can only be resolved at the RPM level. The schedule as presented in the Action Memorandum will be split into three different parts to reflect the Removal Action Response Actions, the Interim Action and the SWOU RI/FS.

EPA also felt that there should be an interim report added to the Interim Action schedule in the Action Memorandum. The interim report could be a technical memo or evaluation report which may include some of the following:

- interpretation of the pump test
- discussion of fisheries and NPDES issues
- modeling results
- evaluation of impact on the spring herring run (and engineering controls to enable upstream migration)
- data which would support the position that the interim action be put off until the SWOU FS

AFCEE agreed to prepare this report and provide a schedule for the interim action which included this report as a decision point.

2. Page 5-3, Extension of Public Water Mains, Figure 9 - This figure (formerly Figure 6) shows water mains along Route 151 only from Ranch Road to the eastern plume boundary. The water main symbol needs to be added through the plume (approximately 3,000 to the west), or an explanation should be provided as to why this extension is not needed.

Response: There are no other residences along Route 151 so adding water mains is not needed. The water main on Route 151 provides a service to the movie theater located on the north side of the highway.

Resolution: The text from the response above will be added to the text.

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

3. Page 5-8, Water Management Practices - AFCEE's response indicates that water management issues associated with winter flooding and year-round operations of the cranberry bogs will be addressed in an addendum to the Fall Harvest Plan. What are AFCEE's plans now with regard to issuing an "addendum" since the Fall Harvest Plan has been disapproved? In any event, the proposed schedule should be amended to reflect this submittal.

Response: Because EPA and DEP would not support the Fall Harvest, there is no water management issue. The bogs will continue to operate as they have in the past. Winter flooding will occur at the discretion of the bog owners and AFCEE will continue to collect surface water samples to evaluate and manage the human health risk.

Resolution: The EPA and DEP still feel that a Water Management Plan should be written. The plan could be combined with the Monitoring Plan so it would explain monitoring of irrigation wells, Coonamessett River water, etc.. It could address the sampling being done to assess the impact of the irrigation wells on the plume and identify contingency plans for providing clean irrigation water if EDB is detected in the irrigation wells. It was agreed that a scoping meeting would have to be held to determine what should be included in the monitoring plan.

II. Issues from EPA Comments in May 2, 1997 letter

4. Section 3.1, p. 3-1 (proceeding bullets) - While the specific issue raised in this comment appears to have been resolved, it is recommended that the following language be added to the report for clarity purposes – "It should be emphasized that the vines and fruit are not exposed to the Coonamessett River. Typically, the bog operators try to keep the water level at least 16 inches below the plants. The only time the plants would be impacted is during flooding or spray irrigation."

Response: The following sentence will be added to the last bullet. "It should be emphasized that the vines and fruit are not exposed to the Coonamessett River. Typically, the bog operators try to keep the water level at least 16 inches below the plants. The only time the plants would be impacted is during flooding or spray irrigation with contaminated water."

Resolution: Agreed

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

III. New Comments

GENERAL COMMENTS

1. When discussing the “leading edge” or “toe” of the FS-28 plume, the text must be very clear as to what is being referred to as being included in the “time critical” removal action and what is being addressed as part of the interim action/final remedy. Typically, Action Memoranda prepared in accordance with EPA’s guidance document, “Superfund Removal Procedures - Action Memorandum Guidance”, dated December 1990, are written to substantiate the need for a removal response. (A copy of this guidance document was given to a representative of AFCEE’s contractor, Jacobs Engineering, earlier this year.) While it may be acceptable to include information on both CERCLA and other response actions that AFCEE has undertaken in response to EDB detections in the FS-28 plume (e.g. CWSW wellhead treatment, installation of new irrigation wells, etc.) in the Action Memorandum the text needs to clearly distinguish between other actions taken to date and the proposed time-critical removal action(s). In addition, all references to “remedial” actions should be removed from the discussion substantiating the need for a “removal” action.

In addition, based on our recent discussions regarding the inclusion of an evaluation of the deeper, leading edge/toe of the FS-28 plume, the document needs to be modified to reflect the fact that the evaluation of this portion of the plume will be conducted prior to the initiation of the SWOU RI/FS.

Response: We agree that discussion of the Interim Action or other characterization of the leading-edge/toe of the FS-28 plume should not be confused with “time-critical” removal actions. We also agree that in this particular case, we are considering the remediation of groundwater (the removal of a contamination source to the surface environment) as a “removal action,” in the way that source removal usually applies to soil contamination. The evaluation of the leading edge of the plume began during the preparation of the Draft FS-28 Technical Decision Memorandum. The physical and analytical data collected during the past year and during the operation of the extraction well EW-1 will contribute to the evaluation of the leading edge of the FS-28 plume.

Resolution: The Action Memorandum text will be revised to make the issue above (distinguishing “time-critical” actions with interim or other actions) more clear.

Delaying the decision to intercept the groundwater contamination at 69MW1300 until the SWOU RI/FS is completed is unacceptable to the EPA. According to EPA if AFCEE is going to take the position that an interim action should not be performed, this decision needs to be justified and documented in an interim deliverable. EPA feels that the contamination at 69MW1300 should be included in any studies or engineering which

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

addresses the leading edge. AFCEE agreed that any leading edge activities would include the contamination at 69MW1300.

2. It is still unclear whether the time-critical removal action incorporates “discharge” or “reinjection” of the treated water. The terms seem to be used interchangeably. Please clarify.

Response: The time-critical removal action (operation of extraction well EW-1) has no “reinjection” component. Treated groundwater will be discharged to the Coonamessett River.

Resolution: Agreed

3. References to Crane Wildlife Management Area, Deep Pond, John Parker Road and Strand Way need to be noted on all figures (the two roads need to be added specifically to Figure 9 where they are referenced in the text). Several other references in the text also do not appear on figures being referenced within a particular discussion such as surface water locations, monitoring wells and irrigation wells.

Response: Comment noted. We will look at the figures and add appropriate geographical references so that the text and figure coincide.

Resolution: Agreed

PAGE-SPECIFIC COMMENTS

1. Page 2-2, Section 2.1.2 - While the action memorandum deals primarily with the leading edge of the plume, the text and figures should also provide information on the source area and lateral extent of the plume. This context is needed to put the proposed action in proper perspective.

Response: We do not believe that adding this information would serve any useful purpose. Source areas are discussed in the Work Plan and the Technical Decision Memorandum. The actions are being taken due to the upwelling of the EDB into the river and to protect human health. No text change is proposed.

Resolution: Agreed

2. Air monitoring data for EDB, as related to cranberry bog irrigation (July 16-17, 1997), suggest that the leading edge of the plume may be downstream of Thomas B. Landers Road (location S1, Figure 2). Surface water data shown on Figure 4 suggests a

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

similar cautionary note. Therefore, adequate monitoring is critical to determining remedial "success" and additional downstream characterization should be undertaken.

Response: As we have tried to put into the numerous reports and work plans, the EDB contamination upwells into one of the cranberry bogs and flows down river. In terms of surface water contamination, the leading edge changes but has been found as far as Great Pond. Surface water stations have been established since November 1996 to track the surface water contamination. The EDB is strictly limited to the main stream channel below Thomas B. Landers Road. The air monitoring data associated with bog irrigation referenced in the comment related to the use of surface water known to contain measurable levels of EDB.

The groundwater EDB contamination is located just north of Thomas B. Landers and there are a series of monitoring wells at the toe of the plume. These monitoring wells have not be sampled since the baseline samples were collected last January. Sampling will likely begin on a quarterly basis this next month.

Resolution: For clarification, the first round of quarterly sampling of the wells at the toe began October 20, 1997.

3. Page 2-10, Second Paragraph. Since this section discusses actions that have already occurred, why does the third sentence of this paragraph discuss surface water samples that WILL be collected. Please explain.

Response: Sentence will be revised to reflect that these actions have already been completed.

Resolution: Agreed

4. Page 2-10, Third Paragraph. State the detection limits in the text at the end of the second line regarding the May 29th sampling.

Response: Sentence will be revised with the detection limit.

Resolution: Agreed

5. Page 2-11 and Figure 6. Please add the EW0001 well to the figure to show its location/depth relative to the "hot spot".

Response: Concur

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

Resolution: Agreed

6. Page 54, Paragraph Proceeding 5.1.1.3. Where are the 25 additional residents that will be provided public water? Are they on Boxberry and Strand? The text is unclear. Please explain.

Response: Figure will be revised to reflect the new residents being added on Boxberry, Hatchville, Strand, etc.

Resolution: Agreed

7. Page 5-5, Second Paragraph. Please add a figure that depicts the surface water locations referenced in the text.

Response: Figure 2 will be revised to show the sampling locations referenced in the text.

Resolution: Agreed

8. Page 5-5, Bottom and Top of Page 5-6. As previously stated, the discussion regarding the interim action and final remedy should be removed from this section and placed in another. Section 5.1.1.4 should focus specifically on the time-critical removal action as the title indicates.

Response: Agreed.

Resolution: Agreed

9. Page 5-6, First Paragraph. Per EPA's August 27, 1997 correspondence, further evaluation of the leading edge of the plume near 69MW1300 should be performed in conjunction with EW-1/removal action data collection and evaluation activities. Concentrations detected in this portion of the plume exceed Maximum Contaminant Levels (MCLs) and should not go unabated until at least 1999 which is the expected timeframe for the submittal of a Record of Decision (ROD) for a final remedy at the SWOU. In addition, the schedule should be modified to include the submittal of a "Draft Removal Action Evaluation Report" which will become an enforceable date. This draft evaluation report must include both an evaluation of performance data for EW-1 (including recommendations for additional interim actions, if necessary) and a discussion on the current status (confirmation of location and contaminant concentrations) of the deeper, leading edge of the FS-28 plume (previously detected at 69MWI300).

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

Response: We believe that the contamination found at 69MW1300 can wait until the SWOU RI/FS is completed. Conducting remediation of this portion of the plume would likely dewater the cranberry bog and cause unacceptable ecological damage. We believe that the prudent course of action is to complete the RI/FS which will provide a detailed assessment of the remedial alternatives. To try to implement while the SWOU RI/FS is yet to be completed may be a waste of resources. The FS will be completed by the later part of 1998 which would then go through public comment and review.

Resolution: The EPA objected to waiting until the SWOU RI/FS to address the contamination in 69MW1300. EPA proposed that a deliverable for interim action include this part and it should justify if further action is required. AFCEE agreed to add this part of the plume to the interim action and issue a conceptual design report for the entire leading edge of the EDB plume. EPA requested that this be added to the schedule since they may want to use this as a decision point and a enforceable milestone.

10. Page 5-8, Section 5.1.1.5. As previously stated, this discussion should be moved to another part of the document. The more substantive portion of the action memorandum should be the discussion on the removal action, with some description of other actions taken to date.

Response: Agreed.

Resolution: Agreed

11. Page 5-9, Section 5.1.1.7. All references to the Fall Harvest Plan need to be amended to reflect the fact the plan will not be implemented.

Response: Agreed.

Resolution: Agreed

12. Page 5-10, Section 5.1.1.8. For consistency, please specify the type of filter system (i.e. GAC filter system) that will be used if EDB is detected in the well.

Response: Agreed.

Resolution: Agreed

13. Page 5-10, Section 5.1.1.8. Please explain why only five out of the six pilot borings were tested.

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

Response: To meet the accelerated schedule for irrigation well installation, the first irrigation well drilled (69IG0004) was installed without a pilot boring. The well water was sampled, following installation.

Resolution: The above explanation will be added to the Action Memorandum text.

14. Page 5-13, First Paragraph. The potential exists for EDB contamination to occur undetected (due to the 7 day lag time between sample collection and analysis) at the Augusta Bog from wells 69SW0061 and 69SW0062. Provisions should be included in this action plan for rapid turn around time of EDB analyses if contamination is suspected at these wells.

Response: Surface water data has been collected over the past year and it would not appear that the contamination would just appear suddenly. So far the area has remained to be non-detect and there is no need for more rapid turnaround of the results.

Resolution: Agreed.

15. Page 5-13, Section 5.1.2. As previously stated, this discussion should be moved to another part of the document. The more substantive portion of the action memorandum should be the discussion on the removal action, with some description of other actions taken to date.

Response: Agreed.

Resolution: Agreed

16. Page 5-14, Section 5.2. As previously discussed, any item listed in this section that does not specifically relate to the proposed removal action (or other actions taken to date that relate to the proposed response action), should be deleted from this page and moved to a later section in the document.

Response: Agreed.

Resolution: Agreed

17. Figure 12. The reference to "Phase II" should be deleted from the title and legend and the "Phase I" reference in the legend needs to state "Time Critical Removal Action." In addition, all lines showing "Phase II" in the figure should also be removed.

Response: Agreed.

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

Resolution: Agreed

18. Figure 15, Schedule for Proposed Actions. The proposed system startup date of November 16, 1998 for the leading edge interim action is unacceptable. As stated previously, it is imperative that the Air Force have a long-term solution in place to capture and treat the leading edge of the plume prior to next year's fall harvest season which can begin as early as September 1.

Response: This will not be possible due to several factors. Firstly, we still do not have an acceptable site for the permanent treatment plant. AFCEE has been in contact with a nearby property owner who is willing to lease a portion of the land for the treatment facility. However, the neighbors near the proposed location are opposed to the building construction. Secondly, until data is collected from EW-1 we are unsure of what influence (for example drawdown and impact on the stream and bogs) the well may have. Most certainly placing further extraction wells near the river (like EW-2 and EW-3) will have an impact since the well screens would likely be higher than EW-1 and closer to the river. Because of these factors we do not believe that a November 1998 startup is practically achievable.

Resolution: Agreed

19. Figure 15. EPA is proposing that an interim deliverable be added to the schedule for irrigation well operation. Specifically, a document should be submitted in the January/February timeframe which evaluates the influence of the irrigation wells on the plume during the 1997 irrigation/harvest season. It is imprudent to wait until two growing/harvesting seasons have passed to formally evaluate the irrigation wells' influence on the plume. In addition, the schedule for operation of the irrigation wells extends well into October 1998. Please explain.

Response: Section 5.1.1.8 provides a detailed discussion of the potential influence of irrigation wells on plume migration. We feel that the impact of irrigation well use on plume migration is too small to reasonably quantify hydraulically. Any effect that would be seen would involve 69IG0004, located at the Thompson Bog. The Action Memorandum proposes to sample 69IG0002, 69IG0003, and 69IG0004 following spray irrigation in the spring and on a monthly basis during the growing season. To date, these wells have been non-detect for EDB. Analytical data from these wells and others will be included in any preliminary design or site characterization report. We believe that groundwater sampling and analysis is the most appropriate method of evaluating effects of groundwater extraction on plume migration.

Resolution: Influence of the irrigation wells on the plume will be evaluated by continuation of the monitoring program at the leading edge which consists of sampling the above referenced irrigation wells biweekly during the irrigation season and quarterly

**EPA COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

sampling the monitoring wells below the leading edge of the plume for EDB. As previously mentioned this plan could be provided in a Water Management Plan and Monitoring Plan. Furthermore, the plan could include the addition of decision trees to implement contingencies in the event that contamination is detected in the irrigation well.

20. Figure 15. This figure needs to be amended to reflect earlier comments on distinguishing between actions relevant to the time critical removal action and the interim action. Specifically, Figure 15 should be a schedule of removal action activities. Separate figures, e.g. Figure 15A and 15B could be created for interim action and SWOU activities.

Response: These activities are already separated and there is no reason for a separate figure for these activities.

Resolution: The schedule for the Interim Action and the SWOU will be separated from the Action Memorandum Actions to indicate that they are not part of the "Time-Critical" Response Actions. Three separate schedules will be added to the Final Action Memorandum. These include the Action Memorandum Response Actions, Interim Action, and the SWOU RI/FS. Residential hookups will be added to the schedule of Action Memorandum Action Items.

**EPA COMMENTS ON THE
DRAFT FS-28 MONITORING PLAN**

GENERAL COMMENTS

1. The Monitoring Plan should contain provisions to incorporate changes based on detections of EDB (similar to those included in the Revised Draft Final FS-28 Action Memorandum). Also, the Draft FS-28 Monitoring Plan should include a brief description of the procedure for notification when EDB contamination has been detected in any of the samples.

Response: Agreed.

Resolution: Agreed

2. The potential exists for irrigation wells to be used for 7 days before they would be determined to have EDB contamination. What are the potential consequences of an irrigation well that is used for 7 days and exceeds the EDB MCL? Provisions must be included in the Monitoring Plan for rapid turn around time of EDB analyses if contamination is suspected at any irrigation well.

Response: Samples have been collected from the 3 monitoring wells closest to the plume (69IG0002, 69IG0003, and 69IG0004) on a regular basis since early spring 1997. EDB has not been detected in these wells under normal operating conditions and is not anticipated to suddenly appear. At this point, there is no need for more rapid turnaround of the results. However, if EDB is detected in the irrigation wells, or other data indicate that the irrigation water supply may be impacted, the sampling and analysis plan may be revised.

Resolution: Agreed

PAGE-SPECIFIC COMMENTS

1. Page 2, Section 2.0, Second Paragraph. Since it is unclear which well is referred to in the last sentence, the text, "the well that has a carbon filtration system," should be revised to "Coonamessett Water Supply Well, which has a carbon filtration system."

Response: Agreed.

Resolution: Agreed

2. Page 3, Section 3.0. Pump Test Setup. Following the first sentence, a statement should be made to justify the omission of a stepped-drawdown pump test. This omission could

**EPA COMMENTS ON THE
DRAFT FS-28 MONITORING PLAN**

be justified on the basis of the quality and quantity of existing data on the well and aquifer.

Response: The text provides the justification, however a statement will be added.

Resolution: Agreed

3. Page 5, Section 3.0, Pump Test Setup. To be consistent with DEP New Source Approval Guidelines, an appropriate and relevant requirement, groundwater levels should be recorded with data loggers for a minimum of five days before the pumping test to establish background groundwater level trends. This will improve the quality of the data at minimal cost. Also, precipitation should be measured at the pump test site throughout the background measurement period, pumping period, and recovery period.

Response: We will do the best to comply with these guidelines, however the aquifer may act differently which is why the data loggers will be placed at least five days before the full system is started up.

Resolution: Agreed

4. Page 5, Section 3.0, Third Paragraph. Please specify the other surface water bodies (other than the Coonamessett River) that will be monitored.

Response: Text will be modified to reflect the sampling of the Broad River as the only other surface water body.

Resolution: Agreed

5. Page 9, Section 6.0. EPA recommends that irrigation wells be tested prior to being used for frost protection and after each irrigation event to ensure that the well water has not been contaminated with EDB.

Response: Agreed.

Resolution: Agreed

**MDPH COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

GENERAL COMMENTS

1. MDPH supports the plan for environmental sampling to continue until a final remedy is implemented. Furthermore, MDPH agrees that the monitoring program may have to be modified based on the results of the initial testing. This may be particularly important for testing the effluent of the carbon filtration unit on EW1. The current plan calls for a month of daily testing to be followed by additional tests every month. After the month of daily testing, the subsequent tests may have to occur more frequently than monthly if the performance of the system is shown to be variable or unpredictable.

Response: Noted. The sampling frequency would only change if such the initial data indicated that discharge exceeding regulatory criteria or environmental thresholds could occur. We are submitted all of the sampling and monitoring information to the regulatory agencies on a weekly basis. Furthermore, EPA has been involved in reviewing the data from a National Pollution Discharge Elimination System viewpoint since startup.

Resolution: Clarification of the above response: AFCEE is submitting all of the sampling and monitoring information to the environmental regulatory agencies and MDPH on a weekly basis.

2. In general, the proposed water sampling program is in accord with the recommendations made by MDPH in previous correspondence. However, the program should also include plans to test the three irrigation wells closest to the FS-28 plume and the Augusta reservoir immediately after each spray irrigation event in the late fall (October through December). The Action Memorandum currently contains plans to perform this type of testing in the early spring (mid April to mid June), but not in the late fall.

Response: It is our understanding that after the autumn harvest, the pumps for the irrigation system are winterized and that spray irrigation does not occur from October through December. We also have observed that all of the sprinkler heads have been removed such that a spray event is not possible this fall.

Resolution: Agreed

3. At a meeting on July 10, 1997 at the MDEP offices in Lakeville, AFCEE agreed to perform an air monitoring program. This program included at least one set of air samples from Reservoir Bog as it is being spray-irrigated with water from Pond 14 by August 1, 1997. And at least five sets of air samples from the Broad River area before September 1, 1997. The FS-28 Action Memorandum should include these plans for air sampling.

**MDPH COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

Response: Agreed. The monitoring plan has changed since the Revised Draft Final FS-28 Action Memorandum was issued. The most significant changes include the removal of performance monitoring for the Fall Harvest Plan, the addition of air sampling, and significant changes to the ecological impact sampling and analysis program. The Final Action Memorandum will include the air sampling program as it was performed. It is also our understanding that at subsequent meetings with regulatory agencies additional air sampling may be conducted if the surface water concentrations were found greater than 0.5 µg/L. This revision will also be included in the Final Action Memorandum.

Resolution: In the October 21, 1997 letter from Suzanne Condon Lt. Col. Barbara Larcom of the Joint Program Office (JPO), the MDPH comments on the September 16th meeting where the JPO proposed that no further air monitoring be conducted unless surface water concentrations of EDB exceeded 0.5 ppb. The MDPH recommends additional air monitoring, however, there have been no changes to the original plan agreed to on September 16th.

4. In response to previous comments by MDPH, AFCEE has requested that MDPH review the available air sampling results and method detection limits to determine the EDB concentrations in surface water above which EDB should be detectable in the air. Given the variety of environmental conditions that are possible, a single EDB concentration in surface water cannot be used to accurately predict whether or not EDB will be detectable in the air. However, MDPH will continue to review the results of the air sampling tests that will be done before September 1, 1997. These results will form the basis for decisions to modify or expand the air sampling program.

Response: Noted. See response to #3.

Resolution: The MDPH does not believe that sufficient information exists to establish a trigger level at which air monitoring should occur, however there have been no changes to the original plan agreed to on September 16th. (See resolution to #3.)

5. In the Action Memorandum, there are references to three different "decision trees" that outline actions to be taken based on sampling results for the Coonamessett Water Supply Well, groundwater and surface water. As we have previously stated, MDPH feels that these decision trees should play only a supportive role for decisions about public health interventions. All positive test results (i.e., when EDB is detected) should be immediately shared with MDPH and other agencies that would like them. If MDPH or other agencies have comments or concerns about particular sampling results, these concerns may take precedence over the actions prescribed by the decision trees.

**MDPH COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

Response: The decision trees are offered as guidance to the decision making process. AFCEE relies on weekly meetings with MDPH and other agencies to present analytical data and discuss technical issues in a timely fashion.

Resolution: Agreed

SPECIFIC COMMENTS

1. It is our understanding that vinyl bromide can only be detected by method 524.2 (GC/MS), not by method 504. Please clarify what percentage of groundwater, surface water, and drinking water samples have been analyzed by method 524.2 since December 1996.

Response: Roughly 5-15 % of the groundwater and surface water samples collected since December, 1996 were submitted for VOC analyses. Very few groundwater and surface samples were submitted for volatile organic compound analysis by method 524.2 after February. Since this time period all of the samples collected are analyzed solely for EDB. However the drinking water samples collected in the spring of 1997 in the Boxberry Hill one time sample were also analyzed for VOCs by either method E524.2 or OLC02.1 by the same laboratory that conducted the method detection limit study for vinyl bromide. But vinyl bromide is not a target compound by either of these methods and would have been reported as a tentatively identified compound (TIC). TIC were not detected.

Additional VOC testing has been conducted on groundwater and surface water sampling but we have not been routinely looking for vinyl bromide. We do not specify that our subcontract laboratories routinely report TICs unless there is a predominant unknown peak present in the sample chromatogram. No unknown peaks have been reported.

Resolution: Agreed

2. The following monitoring wells are not shown on Table 1-6 of the Draft FS-28 Monitoring Plan even though they are listed on Table 1-2: 69MW1284A, 69MW1303B, 69MW1289, and 69MW1285A&B. Please add these wells to Table 1-6.

Response: Agreed. The referenced wells are scheduled for monthly sampling through December and quarterly sampling thereafter.

Resolution: Agreed

**MDPH COMMENTS ON THE
REVISED DRAFT FINAL FS-28 ACTION MEMORANDUM**

3. On Table 1-6 of the Draft FS-28 Monitoring Plan, 69IG0002, 69IG0003, and 69IG0004 should be shown to be tested bi-weekly, not monthly, from mid June to October.

Response: Agreed. The three irrigation wells referenced above are tested bi-weekly from mid June to October.

Resolution: Agreed

4. In Figure 8 of the Action Memorandum, the fifth box from the top should read “EDB detected in intermediate sample?” not EDB collected in intermediate sample?”.

Response: Agreed. The figure text will be revised per comment.

Resolution: Agreed

APPENDIX B

Biweekly Discharge Measurements, Biweekly Surface Water Offsite Laboratory EDB Data and Air Sampling Analytical Data

TABLE B-1
SUMMARY OF DISCHARGE MEASUREMENTS ON THE COONAMESSETT RIVER

Station Number	Date	Time (hrs)	Elevation WS (ft NGVD)	Velocity (fps)	Discharge (cfs)
69SW0006	2/13/97	1120	27.08	0.47	2.98
69SW0006	2/27/97	1355	26.56	0.47	2.55
69SW0006	3/13/97	1055	26.60	0.71	2.79
69SW0006	3/27/97	1425	26.57	0.77	2.81
69SW0006	4/23/97	1050	26.82	1.16	6.29
69SW0006	5/6/97	1100	26.68	0.67	2.98
69SW0006	5/19/97	1315	26.44	1.06	4.41
69SW0006	6/2/97	1050	26.43	1.02	4.33
69SW0006	6/20/97	1205	26.35	0.67	2.74
69SW0006	7/1/97	1325	26.00	0.63	2.10
69SW0009	2/26/97	1055	NA	0.35	3.09
69SW0046	1/6/97	1100	24.58	0.85	8.80
69SW0046	1/13/97	1320	25.01	0.62	6.29
69SW0046	1/14/97	1320	25.02	0.29	2.99
69SW0046	1/15/97	1040	25.02	0.61	6.12
69SW0046	1/16/97	1115	25.02	0.53	5.45
69SW0046	1/21/97	1105	24.91	0.71	6.66
69SW0046	1/30/97	1415	25.02	0.48	4.91
69SW0046	2/7/97	1315	25.42	0.44	4.86
69SW0046	2/13/97	845	25.23	0.39	3.87
69SW0046	2/26/96	1345	24.86	0.69	5.07
69SW0046	3/12/97	1440	23.13	0.68	6.79
69SW0046	3/27/97	1010	23.12	0.76	8.05
69SW0046	4/22/97	1452	23.42	NR	NR
69SW0046	6/2/97	1415	23.49	1.02	12.89
69SW0046	6/20/97	930	23.30	0.91	10.33
69SW0046	7/1/97	1145	23.01	0.99	8.27
69SW0047	1/3/99	1505	22.97	0.80	5.98
69SW0047	1/6/97	1015	23.17	0.96	8.01
69SW0047	1/10/97	1535	23.00	1.23	9.34
69SW0049	1/3/97	1200	16.18	1.41	14.90
69SW0049	1/6/97	825	16.03	1.46	14.50
69SW0049	1/9/97	920	16.10	1.36	12.60
69SW0049	1/9/97	1330	13.11	1.29	13.10
69SW0049	1/10/97	1410	16.14	1.46	14.00
69SW0049	1/13/97	1050	16.12	1.32	12.40
69SW0049	1/14/97	1110	16.12	1.40	13.40
69SW0049	1/15/97	1540	16.07	1.18	11.20
69SW0049	1/16/97	1015	16.10	1.01	9.78
69SW0049	1/21/97	905	16.03	0.98	9.64
69SW0049	1/30/97	1110	16.13	0.90	8.26
69SW0049	2/7/97	1110	16.08	0.91	8.26
69SW0049	2/12/97	1333	15.98	0.88	7.81
69SW0049	2/26/97	1120	16.07	1.01	9.50
69SW0049	3/12/97	1115	16.04	1.01	9.26
69SW0049	3/28/97	1105	16.02	0.97	9.20
69SW0049	4/9/97	1050	16.24	1.17	14.00
69SW0049	4/24/97	1340	16.60	0.91	13.50
69SW0049	5/5/97	1400	16.24	1.15	13.90
69SW0049	5/20/97	1345	16.40	0.96	12.61
69SW0049	6/3/97	1130	16.30	0.96	11.55
69SW0049	6/19/97	1235	16.26	0.92	11.00
69SW0049	6/30/97	1345	16.10	0.73	7.88
69SW0053	1/7/97	1425	10.62	1.18	17.20
69SW0053	1/8/97	1215	9.82	1.30	19.60
69SW0053	1/9/97	1050	9.62	0.96	13.10
69SW0053	1/9/97	1455	9.78	1.33	19.90
69SW0053	1/10/97	1250	9.78	1.24	20.90
69SW0053	1/13/97	910	9.79	1.44	20.00
69SW0053	1/14/97	910	9.76	1.34	18.40
69SW0053	1/15/97	1345	9.73	1.01	14.60
69SW0053	1/16/97	845	9.76	1.06	15.60
69SW0053	2/3/97	945	9.72	0.88	12.90
69SW0053	2/3/97	1030	9.74	0.86	13.00

TABLE B-1
SUMMARY OF DISCHARGE MEASUREMENTS ON THE COONAMESSETT RIVER

Station Number	Date	Time (hrs)	Elevation WS (ft NGVD)	Velocity (fps)	Discharge (cfs)
69SW0053	2/7/97	930	7.58	1.11	17.51
69SW0053	2/12/97	945	7.52	0.92	13.50
69SW0053	2/26/97	845	6.87	1.08	16.21
69SW0053	2/28/97	1230	7.03	1.38	21.58
69SW0053	2/28/97	1345	7.03	1.36	21.25
69SW0053	3/12/97	900	6.86	1.38	18.01
69SW0053	3/28/97	905	6.77	1.15	15.77
69SW0053	4/9/97	905	6.99	1.48	22.64
69SW0053	4/24/97	1100	6.64	1.30	21.92
69SW0053	5/5/97	1100	6.63	1.30	20.22
69SW0053	5/20/97	1145	6.68	1.35	22.11
69SW0053	6/3/97	930	6.50	1.22	18.60
69SW0053	6/19/97	915	6.05	1.26	16.54
69SW0053	6/30/97	1120	5.99	1.17	13.26
69SW0057	1/31/97	1225	35.95	0.68	3.87
69SW0057	2/14/97	840	35.82	0.58	2.83
69SW0058	1/6/97	1505	31.67	1.00	5.62
69SW0058	1/13/97	1450	31.57	1.14	6.11
69SW0058	1/16/97	1400	31.61	0.94	5.36
69SW0058	1/21/97	1340	31.40	0.81	3.38
69SW0058	1/31/97	1115	31.57	0.66	3.62
69SW0058	2/7/97	1510	31.53	0.56	2.28
69SW0058	2/13/97	1330	31.39	0.56	2.45
69SW0058	2/28/97	810	31.33	0.50	1.93
69SW0058	3/13/97	1335	31.47	0.55	2.48
69SW0058	3/28/97	1320	31.39	0.56	2.42
69SW0058	4/9/97	1340	31.75	0.73	4.91
69SW0058	4/23/97	1234	31.79	0.80	5.86
69SW0058	5/6/97	1415	31.45	0.56	3.06
69SW0058	5/19/97	1455	31.60	0.68	4.41
69SW0058	6/2/97	1530	31.64	0.59	4.14
69SW0058	6/20/97	1350	31.45	0.51	2.76
69SW0058	7/1/97	1500	31.35	0.47	1.93

cfs = cubic feet per second

fps = feet per second

hrs = hours

NA = not available

NGVD = national geodetic vertical datum

NR = not recorded due to field conditions

WS = water surface

TABLE B-2
MMR ETHYLENE DIBROMIDE PLUME
BIWEEKLY SURFACE WATER DATA

SAMPLING LOCATION	69SW0003	69SW0006	69SW0009	69SW0014	69SW0024	69SW0046	69SW0047	69SW0049	69SW0051	69SW0052	69SW0053	69SW0054	69SW0057	69SW0058	69SW0060	69SW0061
Sample Date	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)	EDB(ug/L)
Oct 8 '96	ND	ND	ND	0.36	0.013	0.043	0.036	0.025		0.008	0.006	ND				
Nov 22 '96	ND	ND	ND		0.096	0.067	0.057	0.037		ND	ND		ND	ND		
Dec 5 '96	ND	ND	ND		0.069	0.065	0.053	0.034		ND	ND		ND	ND		
Dec 20 '96	ND	ND	ND		0.012	ND	ND	ND		ND	ND		ND	ND		
Jan 3-7 '97	ND	ND	ND		ND	ND	ND	ND		ND	ND		ND	ND		
Jan 17-21 '97	ND	ND	ND		0.022	0.024	0.013	0.01		ND	ND		ND	ND		
Jan 30-31 '97	ND	ND	ND		0.017	0.0084	0.0073	ND		ND	ND		ND	ND		
Feb 12-14 '97	ND	ND	ND		ND	ND	ND	ND		ND	ND	ND	ND	ND		
Feb 26-28 '97	ND	ND	ND	0.12	0.032	0.033	ND	0.019		ND	ND	ND	ND	ND		
Mar 12-13 '97	ND	ND	ND		0.069	0.048	0.042	0.029		ND	ND	ND	ND	ND		
Mar 27-28 '97	ND	ND	ND	0.075	0.081	0.083	0.077	0.038		0.01	0.01	ND	ND	ND		
Apr 9-10 '97	ND	0.102 *	ND	ND*	0.049	0.047	0.049	0.033		ND	ND	ND	ND	ND		
Apr 11 '97		ND	ND	0.074	0.065	0.061	0.041	0.021								
Apr 22-24 '97	ND	ND	0.014	0.28	0.056	0.044	0.033	0.025	0.00701		ND	ND	ND	ND		
May 5-8 '97		0.014	0.014	0.11	0.070	0.066	0.071	0.040	0.00941		ND	ND				
May 19-20 '97		ND		0.14	0.076	0.073	0.056	0.036	0.013		.0075J	ND				
May 28 '97		ND		0.12	0.079	0.057	0.055	0.038	0.012							
June 2-3 '97		ND		0.053	0.067	0.064	0.051	0.044	0.013		.0083J	ND				
June 6 '97		ND		0.13	0.083	0.074	0.058	0.037	ND						ND	ND
June 9 '97		ND		0.12	0.071		0.063	0.039	0.010						ND	ND
June 19-20 '97		0.010		0.14	0.077	0.086	0.056	0.065	.00681		.00981				ND	ND
June 30-July 1 '97				0.13	0.088	0.07		0.045	0.01		ND					
Detection Limit	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004

Note:

Not all data are validated.

SW = Surface Water

J = estimated (above the detection limit but below the quantitation limit)

ND = non-detect

* Samples may have been mis-labelled since results do not match previous sampling.

TABLE B-3
FS-28 Air Monitoring Results

Sample ID	Date Sampled	Date Analyzed	EDB Results (ng/m3)	EDB Results (ppbv)
69AA0014-01	5/14/97	5/19/97	15.0 J	0.002 J
Lab Blank		5/19/97	7.1 J	0.00093 J
69AA0014-02	5/29/97	6/10/97	12.3 U	0.002 U
69AA0014-02 cross	5/29/97	6/10/97	10.4 U	0.001 U
69AA0014-02 down	5/29/97	6/10/97	16.5 U	0.002 U
Trip Blank		6/10/97	7.5 U	0.001 U
Lab Blank		6/10/97	7.5 U	0.001 U
LCS/LCSD Recoveries (spiked at 0.001ppbv)		6/10/97	89 %/86 %	

EDB = ethylene dibromide

J = estimated results

LCS/LCSD = laboratory control sample/ laboratory control sample duplicate

ng/m3 = nanograms per cubic meter

ppbv = parts per billion volume

U = undetected at specified reporting limit



JACOBS
ENGINEERING®

Engineers and Constructors

Jacobs Engineering Group Inc.
Building 318, 318 East Inner Road
Otis ANG Base, Massachusetts 02542
508•564•5746 Fax 508•564•6425

March 23, 1999

Mr. Jim F. Snyder
Remediation Program Manager
HQ AFCEE/MMR
322 East Inner Road, Box 41
Otis ANG Base, MA 02542-5028

RE: **Final FS-28 Time Critical Action Memorandum F41624-94-D-8115, Delivery Order 0025**

Dear Mr. Snyder:

As directed by the Air Force Center for Environmental Excellence, Jacobs Engineering Group Inc. is hereby providing twenty-two bound copies, one unbound copy, and 1 electronic copy of the *Final FS-28 Time Critical Action Memorandum*, dated March 1999. Copies are also being sent to the appropriate agencies.

Please feel free to contact me or Tom Szymoniak at (508) 564-5746 extension 315, if you have any questions or comments.

Sincerely,

Eric W. Banks, P. E.
Program Manager

Enclosures: Document (23 & 1 EDD)



JACOBS ENGINEERING GROUP INC.

CC:

EPA:

Paul Marchessault (3)

DEP:

Lynne Doty (1)

Leonard Pinaud (4)

ARNG:

Jo Ann Watson (1)

David Hill (c/o IRP) (1)

Larry Lumeh (1)

Mary Ellen Maly (1)

GANNETT FLEMING:

Scott Richmond (2)

FOOT HILL ENGINEERING:

Jim Quinn (1)

JACOBS ENGINEERING GROUP INC.:

Tom Szymoniak, JEG (1)

File - Document Control, JEG (2)



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
INSTALLATION RESTORATION PROGRAM
OTIS AIR NATIONAL GUARD BASE, MA 02542-5028

25 Mar 1999

MEMORANDUM FOR AFCEE/JA

ATTENTION: MR. WILLIAM DICK

FROM: HQ AFCEE/MMR

322 East Inner Road, Box 41

Otis ANG Base, MA 02542-5028

SUBJECT: Final Document

1. Attached please find a copy of the document entitled "Final FS-28 Time Critical Action Memorandum " dated March 1999.
2. If you have any questions, please call Marty Aker (508) 968-4670, extension 4971.

JIM F. SNYDER
Remediation Program Manager

Attachment:

Document (one copy)

cc:

Marty Aker (w/o atch)



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
INSTALLATION RESTORATION PROGRAM
OTIS AIR NATIONAL GUARD BASE, MA 02542-5028

25 Mar 1999

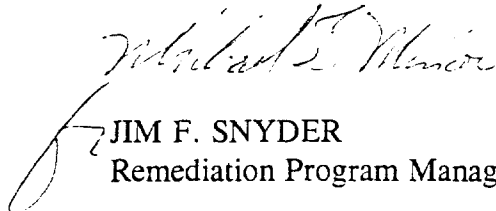
MEMORANDUM FOR AFCEE/ERC

ATTENTION: MS. BARBARA SMITH-TOWNSEND

FROM: HQ AFCEE/MMR
322 East Inner Road, Box 41
Otis ANG Base, MA 02542-5028

SUBJECT: Final Document

1. Attached please find three (3) copies of the document entitled "Final FS-28 Time Critical Action Memorandum " dated March 1999.
2. If you have any questions, please call Marty Aker at (508) 968-4670, extension 4971.


JIM F. SNYDER
Remediation Program Manager

Attachment:
Documents (3 copies)

cc:
Marty Aker (w/o atch)



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
INSTALLATION RESTORATION PROGRAM
OTIS AIR NATIONAL GUARD BASE, MA 02542-5028

25 Mar 1999

MEMORANDUM FOR SAF/LLP

ATTENTION: MS CHARLOTTE MOYER

FROM: HQ AFCEE/MMR
322 East Inner Road, Box 41
Otis ANG Base, MA 02542-5028

SUBJECT: Final Report

1. Please be advised that the "FS-28 Time Critical Action Memorandum" dated March 1999 has been issued as a final document.
2. If you have any questions, please call Marty Aker at (508) 968-4670, extension 4971.

A handwritten signature in cursive script, appearing to read "Jim F. Snyder", is written over the typed name.

JIM F. SNYDER
Remediation Program Manager

cc
Marty Aker (w/o atch)



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
INSTALLATION RESTORATION PROGRAM
OTIS AIR NATIONAL GUARD BASE, MA 02542-5028

25Mar 1999

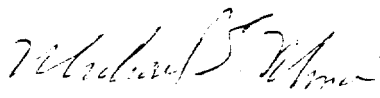
MEMORANDUM FOR NGB-PAI-E

ATTENTION: MR. JOHN REINDERS

FROM: HQ AFCEE/MMR
322 East Inner Road, Box 41
Otis ANG Base, MA 02542-5028

SUBJECT: Final Document

1. Attached please find the document entitled "Final FS-28 Time Critical Action Memorandum " dated March 1999.
2. If you have any questions, please call Marty Aker at (508) 968-4670, extension 4971.


JIM F. SNYDER
Remediation Program Manager

Attachment:
Document (one copy)

cc:
Marty Aker (w/o atch)